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Table of Contents.

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ORIGINAL ARTICLES— Page.
The Reaction of Iodine with Preparations of the Thyreotrophic Hormone, by Lesbia E. A. Wright and V. M. Trikojus 541

REPORTS OF CASES—
A Case of Tuberculous Ulcer of the Vulva, by W. D. Cunningham 546

REVIEWS—
Human Torulosis 546

CORRIGENDUM 546

LEADING ARTICLES—
Prognosis 547

CURRENT COMMENT—
The Absorption of Salicylates 548
The Blood Sedimentation Rate 548
The Spleen and Blood Coagulation 549

ABSTRACTS FROM MEDICAL LITERATURE—
Ophthalmology 550
Oto-Rhino-Laryngology 551

CONGRESSES—
The Australian and New Zealand Association for the Advancement of Science 552

BRITISH MEDICAL ASSOCIATION NEWS— Page.
Notice 575

CORRESPONDENCE—
Pain in an Amputation Stump Associated with Spinal Anæsthesia 575

NAVAL, MILITARY AND AIR FORCE—
Appointments 575

POST-GRADUATE WORK—
The Post-Graduate Committee in Medicine in the University of Sydney 575

NOMINATIONS AND ELECTIONS 576

OBITUARY—
Augustus Leo Kenny 576
Edward Daunt Byrne 576
William Edward Harrison 576
Sydney Norman Rorke 576

BOOKS RECEIVED 576

DIARY FOR THE MONTH 576

MEDICAL APPOINTMENTS: IMPORTANT NOTICE .. 576

EDITORIAL NOTICES 576

THE REACTION OF IODINE WITH PREPARATIONS OF THE THYREOTROPHIC HORMONE.[1]

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IN the regulation of thyreoid function, iodine intake, circulating thyreoidal hormone and the thyreotrophic hormone of the anterior lobe of the pituitary all play important roles, although the interrelationships between these three factors still await clarification on the question of pituitary-iodine interaction. Small amounts of iodine have been shown to reduce the effects on the thyreoid of thyreotrophic hormone concurrently administered to guinea-pigs (Anderson and Evans, 1937; Trikojus, 1939; Trikojus and Ellis, 1939) and to lower the content of thyreotrophic hormone in the pituitaries of rats (Loeser and Thompson, 1934). Whilst there is evidence to support the contention that iodine exerts its effects by direct action on the thyreoid gland (compare Means, 1944; Chapman, 1941; Chapman and Higgins, 1944), the possibility of an additional indirect effect mediated through the pituitary gland has not been excluded, since there is a paucity of recent data concerning the distribution and function of administered iodine in reference to this gland. Considered otherwise, a reaction involving iodine and the thyreotrophic hormone might conceivably occur within the thyreoid gland, the tissues of which are highly specialized for iodine uptake and for reactions involving this element, while the thyreotrophic hormone is known to exert intra-thyreoidally its main physiological function.

In the experiments reported below, the reactions between iodine and preparations of the thyreotrophic hormone have been studied *in vitro*, under conditions of hydrogen ion concentration and temperature comparable with those occurring in the body, and the properties of the products have been examined. (See also Trikojus, 1942.)

EXPERIMENTAL INVESTIGATION AND RESULTS.

Thyreotrophic Hormone.

Two preparations were chiefly used in this work: *A*: A limited quantity of a highly purified hormone containing 34 Junkmann-Schoeller units per milligramme (Junkmann and Schoeller, 1932) and stated to be free from gonadotrophic, growth and lactogenic factors.[1] Chlorine (probably from sodium chloride), but no iodine, was detectable by microanalytical methods. Nitrogen assay gave 14·2%, while the tyrosine value[2] (method of Lugg, 1938) was 3·9%. These results have been calculated for material dried over phosphorus pentoxide in high vacuum. *B*: A less pure preparation extracted from lyophilized ox anterior pituitaries as follows:

Anterior pituitary powder (100 grammes) was shaken for twenty-four hours at room temperature with two litres of 0·75% (weight in volume) sodium bicarbonate solution and centrifuged, and the residue was further extracted with 700 millilitres and 300 millilitres of the alkaline solution. The supernatant liquors were brought to pH 4·5 to 5·0 with acetic acid, the precipitate was centrifuged and discarded and the clear liquor was poured into seven volumes of acetone with agitation. The precipitate was washed with 7:1 acetone/water, dried over phosphorus pentoxide and then extracted three times with distilled water by shaking for several hours, and centrifuged, and the combined

[1] This investigation was carried out whilst one of us (L.E.A.W.) was in receipt of a grant from the National Health and Medical Research Council of Australia.

[1] Donated in 1939 by Professor W. Schoeller (Schering) as a special preparation.

[2] This result is only approximate and represents the mean of two readings (variation ± 0·1) on the hydrolysate from a 25-milligramme specimen. This small quantity necessitated a slight modification of the original methods.

liquors (about 600 millilitres) were poured into seven volumes of acetone. After being washed with 7:1 acetone to water, and with acetone, the precipitate was dried *in vacuo* over phosphorus pentoxide. The yield was eight to ten grammes of a white powder, completely soluble in water and containing, according to approximate assays, one to three Junkmann-Schoeller units per milligramme. Dialysis increased the activity to approximately five units per milligramme.

Iodination.

For iodination the method of Ludwig and von Mutzenbecher (1939) was purposely chosen, since it provides a medium for the conversion of tyrosine containing proteins into derivatives comparable in their action with thyreoglobulin; such conditions may be considered as partly reproducing those present in the thyreoid gland.

Finely powdered iodine, or, in the case of very small quantities, iodine as concentrated solution of iodine in methanol, was added to a 1·25% solution (weight in volume) of the hormone in aqueous sodium bicarbonate solution (three milligrammes of sodium bicarbonate per two milligrammes of iodine used), the temperature being maintained at 37° C. The reaction vessel was a flask or test tube fitted in either case with a side-neck and stirrer with glass bearing. Iodine was taken up immediately by the protein in the early stages, but for complete saturation with the larger quantities, the reaction was allowed to proceed until the colour of the solution was pale yellow. In the case of the purified hormone *A*, quantities of 50 milligrammes or 100 milligrammes were used with a range of 0·8% to 40% by weight of reacting iodine, while for the iodination of preparation *B* larger amounts (up to ten grammes) were treated with the constant proportion of 40% of iodine in all experiments (see Table I). At the conclusion of the reaction the solution was cooled and poured into seven volumes of acetone containing acetic acid (equivalent to the bicarbonate used), the precipitate was washed with 7:1 acetone to water, then with acetone, and dried over phosphorus pentoxide *in vacuo*. It was then dissolved as far as possible in N/40 sodium hydroxide solution (four milligrammes per 100 millilitres); the clear separated liquor was dialysed until free from iodide ion and was then treated with seven volumes of acetone containing the equivalent of acetic acid. After being washed twice with ethanol and twice with acetone, the precipitate was dried over phosphorus pentoxide *in vacuo*. From 100 milligrammes of the purified hormone *A* recoveries of iodinated material as high as 95 milligrammes were obtained. Lower percentage yields were obtained from the crude hormone. The iodoproteins were obtained as white to pale yellow powders readily soluble in water or saline solution.

Iodine Analyses.

Iodine assays were carried out in the apparatus devised by Leipert (1933), the modified procedure of Baumann and Metzger (1939) being used. In certain instances (marked with an asterisk in Table I) check analyses were made by means of the micro-Carius technique (by Dr. G. Burger, University of Adelaide).

TABLE I.

Iodination of Thyreotrophic Hormone. Products of the Reaction between Iodine and the Thyreotrophic Hormone (Preparations A, 34 Units per Milligramme, and B, One to Three Units per Milligramme). Iodine Values of the Modified Hormones and the Results of Qualitative Guinea-Pig Tests for Residual Thyreotrophic Activity and for Free Phenolic Hydroxyl (Millon's Reaction).

Reacting Iodine. (Milligrammes per 100 Milligrammes of Hormone.)	Preparation Number.	Iodine in Product. (Percentage.)	Thyreotrophic Activity.				Result of Millon's Test.
			Milligrammes per Day.	Period. (Days.)	Number of Animals.	Result.	
			Purified Hormone A (*34 Units per Milligramme.*)				
40	W_5	7·6[1] 7·3	1	5	2	Negative.	Negative.
40	W_6	7·8[1] 7·6	4	5	2	Negative.	Negative.
40	W_{13}	6·8[1] 6·6	3	4	2	Negative.	—
20	W_{11}	4·3[1] 4·5	3	4	2	Negative.	Negative.
8	W_{12}	2·0[1]	3	4	2	?	—
8	W_G	2·6 2·7	1	2	2	Positive.	Positive.
4	W_9	0·49[1] 0·40[1]	3	2	2	Positive.	Positive.
4	W_{14A}	0·30[1]	3	4	2	Positive.	Positive.
1·6	W_F	0·24 0·29	1	2	2	Positive.	Positive.
0·8	W_{10}	0·31[1]	3	2	2	Positive.	Positive.
			Hormone Preparations B (*Crude Hormone*).				
40	W_{A+B}	3·6	10	4	2	Negative.	Negative.
40	W_C	—	5	4	2	Negative.	Negative.
40	$W_{D2(i)}$	3·8 3·7 3·6	10	4	2	Negative.	Negative.
40	$W_{D2(ii)}$	4·0 4·1 3·9	10	4	2	Negative.	Negative.
40	$W_{D2(iii)}$	4·9 4·8 4·8	10	4	2	Negative.	Negative.

[1] Analyses by micro Carius method (Dr. Burger).

TABLE II.

Mean Thyreoid Acinar Cell Heights of Guinea-Pigs after Treatment for Three Days (Two Injections) with W_F ($I = 0{\cdot}27\%$) and W_G ($I = 2{\cdot}65\%$), Iodohormones Resulting from Hormone Preparation A (34 Units per Milligramme). Statistical Evaluation of Data.

Group Number and Treatment.	Number in Sample (n).	Acinar Cell Heights. (μ)		Significant Differences between Samples.	D/F.	Difference.	Standard Error.	t	P
		Mean.	Standard Error.						
I. W_F; 1·0 milligramme per day	4	5·78	0·23	VI– I	21	−2·05	0·28	7·27	<0·001
II. W_F; 0·5 milligramme per day	4	4·10	0·23	VI–IV	21	−3·14	0·31	10·07	<0·001
III. W_F; 0·2 milligramme per day	4	4·28	0·23	IV– I	21	+1·09	0·35	3·10	<0·01
IV. Uniodinated hormone (preparation *A*); five units (0·14 milligramme) per day	3	6·87	0·27	IV– II	21	+2·77	0·35	7·86	<0·001
V. W_G; 0·25 milligramme per day	4	3·90	0·23	IV–III	21	+2·59	0·35	7·37	<0·001
VI. Controls	8	3·73	0·16	IV– V	21	+2·97	0·35	8·43	<0·001

Animal Assays.

Thyreotrophic Activity.

Immature guinea-pigs (about 200 grammes in weight) were injected intraperitoneally for short periods (two to five days) with equal parts of a saline solution of the substance; they were sacrificed twenty-four hours later and the thyreoids were removed and examined microscopically (eosin-hæmatoxylin stain). Two animals were used for each substance tested. If hyperplasia and colloid absorption were exhibited by the thyreoids of both animals, a positive thyreotrophic response was recorded (Table I). Two control animals were used in each test.

The material available from the several experiments involving partial iodination was insufficient for quantitative assays. However, with the preparations from two experiments (W_G and W_F), in which residual thyreotrophic activity was present after reaction with small amounts of iodine, a comparison of the thyreotrophic potency was made with the original uniodinated hormone (preparation *A*). Table II shows the mean acinar cell heights of the thyreoids of the groups of animals receiving injections of the stated quantities of iodinated material, together with those of a normal control group and of one receiving five units (0·14 milligramme) of preparation *A*. Individual cell heights represented the mean values of 50 acini per section cut longitudinally near the centre of each gland, the technique being essentially similar to that described by Griesbach and Purves (1943), an etched scale on thin glass and a magnification of 1,000 being used. The data were analysed by the analysis of variance technique, which showed that the variation due to treatment was highly significant ($F = 28{\cdot}60$, $P < 0{\cdot}001$). The standard errors of the means were derived from the error variance in the analysis with 21 degrees of freedom. Hence, in testing the difference between any two means, the value of t obtained had 21 degrees of freedom associated with it, and the criterion of significance was that the probability corresponding to this value of t should be less than 0·05. The results show that a considerable reduction in thyreotrophic activity had been brought about by the action of small amounts of iodine. Preparation W_F at a weight level seven times that of the uniodinated hormone had significantly less activity, while one-half and one-fifth of this dose effected no change in the thyreoid gland. Preparation W_G was ineffective at the level of 0·25 milligramme per day, although slight activity was qualitatively detected (Table I) at the higher level of one milligramme per day.

In Table I are also recorded the results of the reactions of the iodinated products with Millon's reagent. It may be noted that although casein, horse and human serum albumin and purified thyreoglobulin all gave positive results to Millon's test, only thyreoglobulin gave a negative result after each of these proteins had been iodinated under the conditions of Ludwig and von Mutzenbecher (1939) and with the ratio of reactants used by these workers.

Antithyreotrophic Activity.

For the estimation of antithyreotrophic activity the test substance, in saline solution, was administered intraperitoneally in divided doses during a period of four or five days, while in addition an injection of thyreotrophic hormone was given by the same route concurrently or on the last two days of the assay period. The animals were sacrificed twenty-four hours after the last injection and the thyreoids were submitted to microscopic examination, antithyreotrophic activity being designated as "positive" when the epithelium was not raised and when there was retention of colloid (Table III). Control pairs of animals receiving hormone or iodinated product alone were used in each test.

TABLE III.

Results of Qualitative Tests for Antithyreotrophic Activity in Highly Iodinated Preparations of Thyreotrophic Hormone. (For Iodine Contents of Products, see Table I.) Guinea-Pig as Test Animal.

Preparation Number. (Iodohormone.)	Milligrammes per Day.	Period. (Days.)	Supplementary Hormone.[1]	Number of Animals.	Result.
Iodinated Purified Hormone A.					
W_5	2	5	5 × 3 units.	2	Positive.
W_6	4	5	5 × 5 units.	4	Positive.
Iodinated Hormone Preparations B.					
W_{A+B}	10	4	2 × 5 milligrammes.	2	Positive.
W_C	5	4	2 × 5 milligrammes.	2	Positive.
	5	4	2 × 5 units.	2	Positive.
$W_{D2(i)}$	10	4	2 × 5 milligrammes.	2	Positive.
	10	4	2 × 5 units.	2	Positive.
$W_{D2(ii)}$	10	4	2 × 5 milligrammes.	2	Positive.
	10	4	2 × 5 units.	2	Positive.
$W_{D2(iii)}$	10	4	2 × 5 milligrammes.	2	Positive.
	10	4	2 × 5 units.	2	Positive.

[1] Hormone expressed as "units" refers to hormone *A*; as "milligrammes" to the hormone preparation in the *B* series used for the particular iodination.

In a comparative test of antithyreotrophic activity, five groups of four guinea-pigs were injected with preparation W_6 (four milligrammes per day for five days), and on a basis of equivalent iodine content, with iodocasein (Ludwig

and von Mutzenbecher, 1939), thyroxine, diiodotyrosine and potassium iodide respectively, the last three compounds being administered subcutaneously and the other two intraperitoneally. In addition, all animals received five units per day of thyreotrophic hormone (preparation *A*). Two further groups provided normal controls and animals in receipt of thyreotrophic hormone only. The results of statistical treatment, by the analysis of variance technique, of the mean data obtained from measurements of the thyreoid acinar cell heights in the several groups are presented in Table IV. These show that only iodocasein was able to inhibit completely the effects of concurrently administered thyreotrophic hormone. Both thyroxine and the iodinated hormone (W_6) provided some protection, but the mean acinar cell heights of the groups receiving potassium iodide or diiodotyrosine together with hormone did not differ significantly from those of the group receiving hormone alone. The comparatively large doses of hormone used (a total of 25 units per animal) and the short period would explain the absence of a potassium iodide inhibitory effect in this experiment. The criterion of significance used was that the probability *P*, corresponding to *t* values associated with 21 degrees of freedom, should be less than 0·05.

Table IVa.

Comparison of Antithyreotrophic Effects of Iodinated Thyreotrophic Hormone (W_6 from Hormone Preparation A; I = 6·82; 4 milligrammes per day) and Thyroxine (T.), Potassium Iodide (KI), Diiodotyrosine (D.I.T.) and Iodocasein (I.C., 4 milligrammes per day), all at Iodine-Equivalent Dose Levels. Injections Daily for Five Days concurrently with Thyreotrophic Hormone (T.H., 5 units of Preparation A). Mean Thyreoid Acinar Cell Heights and Significant Differences between Groups.

Group Number.	Treatment.	Mean.	Standard Error.	n
I ..	T+T.H.	6·48	0·30	4
II ..	KI+T.H.	6·53	0·30	4
III ..	W_6+T.H.	6·45	0·30	4
IV ..	D.I.T.+T.H.	6·55	0·30	4
V ..	I.C.+T.H.	5·30	0·30	4
VI ..	T.H. alone	7·40	0·30	4
VII ..	Controls	4·80	0·30	4

Hydrolysis Experiment with Iodinated Hormone (from Preparation B).

Since the iodination of tyrosine under the conditions used in this paper generally does not stop at the stage of substitution to 3:5 diiodotyrosine, but proceeds to the formation of thyroxine (Ludwig and Mutzenbecher, 1939; see also Harington and Pitt Rivers, 1945), attempts were made to isolate in a pure condition the iodine-containing fragments of the protein after hydrolysis, as in the following experiment. Preparation W_{A+B} (3·1 grammes; I = 3·6%) was hydrolysed with bartya under the conditions used by Ludwig and von Mutzenbecher (1939) except that the temperature of the heating bath was raised gradually to 135° to 140° C., this temperature range being maintained during the last seven hours. However, neither the resulting crude acid-insoluble material (42 milligrammes; I = 23·4%) nor the mother liquor could be resolved into thyroxine, diiodotyrosine or other crystalline product. An appreciable thyroxine content was not anticipated, since animals injected with W_{A+B}, and other highly iodinated preparations in both series, continued to gain in weight during treatment.

Deiodination Experiments.

Harington and Neuberger (1936) were partly successful in regenerating hormonal activity in iodo-insulin (prepared under strongly alkaline conditions) after catalytic deiodination (hydrogenation); but we were unable, by treatment along similar lines, to restore thyreotrophic activity to our highly iodinated materials inactivated as described above. Platinum oxide, palladium-barium sulphate and palladium-calcium carbonate, prepared by standard methods, were tried as catalysts, the activity of the last-mentioned being checked by demonstrating the conversion of pure diiodotyrosine to tyrosine in high yield under analogous conditions. Blatherwick, Bischoff, Maxwell, Berger and Sahyun (1927), and Jensen, Schock and Sollers (1932), showed that iodine in dilute aqueous solution in the pH range of 6·8 to 8·0 caused irreversible inactivation of insulin.

Discussion.

It may be concluded from the results reported above that inactivation of both crude and purified thyreotrophic hormone can be brought about *in vitro* by iodine under conditions of pH and temperature corresponding to those occurring in the body. By prolongation of the action of iodine, iodoproteins of high iodine content were obtained which could provide significant protection from the effects of the original hormone concurrently administered to the guinea-pig. It is not suggested that this apparent reversal of the function by iodine is of physiological importance; it is probably related to the inhibitory effect of a low content of thyroxine in the highly iodinated proteins brought about under the conditions of iodination used in these experiments. However, all our preparations contained iodine in varying amounts, and since, in the absence of suitable equipment, we were unable to establish the homogeneity of even our purified hormone, it should be considered whether the inactivation of the hormone by iodine is merely apparent. Iodine may have been taken up by a protein contaminant, so that the latter was rendered antithyreotrophic, with progressive increase in potency, the hormone fraction remaining comparatively unchanged. However, the fully iodinated products (for example, preparations W_5 and W_6) were only moderately antithyreotrophic towards concurrently administered hormone (five units per day; see Tables III and IVa), whereas if the hormone fraction had not been affected by reaction with iodine, the modified contaminant would have been required to neutralize a much greater quantity (100 or more units per day) in the tests carried out on these products (also W_{11} and W_{12}) for thyreotrophic activity (Table I). It is, therefore, a reasonable assumption that iodine exerts a direct inactivating effect on the hormone component. In view of the consistently low iodine contents of the products obtained by iodination of the purified hormone with up to 4% reacting iodine (Table I), in association with a pronounced reduction in thyreotrophic potency as exemplified in Table II, it seems likely that the preferential mechanism of inactivation is oxidation and not iodination. Blatherwick *et alii* (1927; see also Jensen *et alii*, 1932) observed that at pH 8·0 only one-eighth to one-seventh of the amount of iodine was necessary to inactivate insulin as to saturate the molecule with this element.

If iodine-inactivation of the thyreotrophic hormone were to occur *in vivo* either in the thyreoid or pituitary glands, or even elsewhere in the body, some clarification of the

Table IVb.

Significant Differences (ν=21).

Group Number.	Difference.	Standard Error.	*t*	*P*	Group Number.	Difference.	Standard Error.	*t*	*P*
VI– I	+0·93	0·43	2·15	<0·05	III– V	+1·15	0·43	2·68	<0·02
VI–III	+0·95	0·43	2·21	<0·05	IV– V	+1·25	0·43	2·91	<0·01
VI– V	+2·10	0·43	4·89	<0·001	I–VII	+1·68	0·43	3·90	<0·001
VI–VII	+2·60	0·43	6·05	<0·001	II–VII	+1·73	0·43	4·01	<0·001
I– V	+1·18	0·43	2·73	<0·02	III–VII	+1·65	0·43	3·84	<0·001
II– V	+1·23	0·43	2·85	<0·01	IV–VII	+1·75	0·43	4·07	<0·001

physiological effects of iodine might be afforded. No entirely satisfactory explanation has yet been given of the mechanism or mechanisms by which iodine brings about a temporary amelioration of the symptoms of Graves's disease. The conclusion to be drawn from various investigations is that within the hyperactive thyreoid gland both the rate of cellular respiration and that of secretion are raised, while de Robertis (1943) has demonstrated by microtechniques an increased proteolytic activity in the colloid material, and has assumed a consequential additional degradation of thyreoglobulin into diffusible components. The thyreotrophic hormone would appear to act as an accelerator for the various enzyme systems involved—perhaps at different levels.

Salter and Lerman (1936; see also Salter, 1940) explain the action of iodine in thyreotoxicosis on the basis of a reversal of the enzyme systems in favour of synthesis and intrafollicular deposition of hormone, whereas it may be inferred from the observations of de Robertis (1943) that a proteolytic enzyme (or enzymes) is involved with reduced or reversed function. Soskin and Levine (1944) have offered the suggestion, based on the observations of Reineke and Turner (1942), that overiodination of casein leads to iodocaseins of low potency, that the colloid of the thyreoid of Graves's disease is similarly affected by the iodine administered. However, the studies of Gutman, Benedict, Baxter and Palmer (1932) and of Cavett and co-workers (1935, 1936) do not reveal an abnormally high iodine content in the colloid of the preiodized glands taken at operation.

Rawson and colleagues (1943) have made the fundamental observation that the pituitary hormone is partly inactivated by association with thyreoid tissue, particularly that of toxic goitre (taken in all cases from patients treated preoperatively with iodine, which, according to Gutman *et alii* (1932), leads to an increased inorganic iodine content in the gland). As reported by Means (1943, 1944), further investigation has shown that the mechanism of inactivation is oxidative in nature, and that activity can be restored by reducing agents such as glucose or ascorbic acid. Moreover, thyreotrophic hormone has been shown to be present in appreciable quantities in the urine of patients suffering from thyreotoxicosis, but in an inactive form. Translating these observations to conditions *in vivo*, it would seem that a greater degree of "inactivation" by thyreoid tissue in a state of hyperfunction would represent a shift of the equilibrium towards the oxidized form of the thyreotrophic hormone.

In toxic goitre there is an elevated receptivity for iodine as demonstrated by American investigators with radioactive iodine (for example, Hertz, Roberts and Salter, 1942). If iodine is the effective oxidizing agent in the biogenesis of thyroxine (Harington and Pitt Rivers, 1945), then its presence in increased amount in the hyperactive gland should favour the synthetic process, while another role might involve, according to our results, a reduction in the concentration of "active" thyreotrophic hormone available to the gland by intrathyreoidal reactions concerned with a simple iodine-oxidation of the stimulator. Exacerbation of the symptoms of the disease when iodine treatment is prolonged could be accounted for by the assumption of a further increase in thyreotrophic hormone production by an abnormally functioning pituitary gland, in the presence of a lower concentration of circulating thyreoid hormone. Intrathyreoidal inactivation of thyreotrophic hormone by iodine will not now be so effective as initially, since the avidity of the originally hyperplastic gland for iodine becomes diminished as colloid accumulates under the influence of this element.

SUMMARY.

1. Under conditions of hydrogen ion concentration and temperature comparable with those existing in the body, iodine has been shown to react with preparations of the thyreotrophic hormone yielding ultimately completely inactivated products, containing iodine, which exhibits in fact some antagonism towards hormone concurrently administered to the guinea-pig. It is considered that the mechanism of inactivation is primarily one of oxidation rather than of iodine substitution.

2. With the assumption that inactivation of the thyreotrophic hormone by iodine can occur *in vivo*, particularly intrathyreoidally, a mode of action of this element, when administered in Graves's disease, is discussed.

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Addendum.

Since this paper was prepared for publication, two communications have been received which have a bearing on the above discussion. Rawson, Moore, Peacock, Means, Cope and Riddell (1945) also consider the possibility that the involuting effect of iodine in Graves's disease may be due to an inhibitory action on the thyreotrophic hormone, but they point out that normal subjects in receipt of iodine therapy do not develop symptoms of hypothyreoidism. Consequently these workers prefer to assume the mode of action to be concerned with the inhibition of an increased sensitivity of the thyreoid cell to the thyreotrophic hormone. However, iodine and thyreotrophic hormone interaction would alter both components functionally, with consequent changes in the iodine-thyreoid-pituitary equilibrium. In the normal subject given iodine, readjustment to the requisite balance could more readily be effected than under the conditions existing in the thyreotoxic subject with extensive initial metabolic derangement and a pituitary gland under stress.

De Robertis, in continuing his studies on the proteolytic enzyme of thyreoid follicles, has briefly reported (de Robertis and Nowinski, 1946) the results of *in vitro* studies which revealed pronounced inhibition of proteolytic activity by free iodine (but not by potassium iodide). Whether this is the sole clinical effect of iodine, as suggested by these authors, or a supplementary function, must await further clarification.

Reports of Cases.

A CASE OF TUBERCULOUS ULCER OF THE VULVA.

By W. D. Cunningham,
Sydney.

The patient, a widow for seven years, aged thirty-one years, came to the Anti-Tuberculosis Dispensary complaining of cough and sputum of two years' duration, of loss of weight and of frequent night sweats. She had been treated in 1943 for pleurisy and in 1945 for dengue fever. Her father and uncle had both been treated for pulmonary tuberculosis. X-ray examination of her lungs revealed bilateral tuberculosis with cavitation. She complained of a vaginal discharge and was referred to the gynæcological out-patient department. The vaginal discharge had been present for two years and was profuse and yellow in colour. Her menstrual periods were regular, and had a twenty-one day cycle and a duration of seven to twelve days; the loss was moderate. Four years earlier she had had a miscarriage at the third month of pregnancy, but no other pregnancies.

On examination of the patient, her general condition and colour appeared good. The breasts were normal. Vaginal examination revealed a shallow ulcer of irregular outline approximately two centimetres in diameter, with a shaggy yellow floor and undermined edges, situated on the inner surface of the right *labium minus*, extending to the fourchette downwards and to the hymenal tags up the right vaginal wall. It was exquisitely tender. No inguinal adenitis was present. The uterus, cervix and Fallopian tubes appeared normal.

The patient was admitted to hospital. In a smear and culture of material from the ulcer floor numerous mixed cocci and bacilli were found, but no tubercle bacilli. Dark-ground illumination revealed no spirochætes. The Wassermann and Kline tests failed to produce a reaction. A guinea-pig was inoculated.

On examination of the patient under anæsthesia, the uterus, Fallopian tubes and ovaries seemed normal to bimanual palpation. A biopsy of the ulcer was taken and a curettage of the uterus performed.

Microscopic examination of the specimen of curettings showed that the endometrium was in a follicular phase. In the section of the biopsy was seen squamous epithelium, beneath which were masses of subacute inflammatory cells. Scattered throughout were small tubercles consisting of epithelioid cells and tuberculous giant cells. In one or two areas a little necrotic tissue could be found in the centre of the tubercles. Acid-fast bacilli could be found throughout the section.

Treatment on general lines has been carried out. Local excision of the ulcer may yet be performed. Treatment with promin or streptomycin has been suggested.

Reviews.

HUMAN TORULOSIS.

A monograph on "Human Torulosis", by L. B. Cox and Jean C. Tolhurst, of the Alfred Hospital, Melbourne, embodies the most complete and painstaking study of this subject from the clinical, pathological, microbiological and experimental standpoints that has yet appeared.[1] Invasion of the human body by the yeast-like fungus *Torula histolytica* has been thought to occur rarely. A chronic meningitis or meningo-encephalitis is the disease most often produced when invasion does occur, and may be fatal; the lungs and pleuræ, the lymph glands and various other organs may also be affected. No beneficial treatment has been discovered. The authors describe in detail thirteen cases of torulosis which have occurred in Victoria, and state that they have knowledge of about twenty others, some recorded, others not, which have occurred in Australia; so that torulosis would seem to be not so rare a disease as has been supposed but to go often unrecognized. This monograph, since it will no doubt become the standard work of reference on its subject for a good many years to come, should find a place in every pathological and central medical library. It is printed and produced in a manner worthy of the excellence of the text and illustrations.

Corrigendum.

In the issue of October 12, 1946, a review of "Essays and Studies" by W. A. Osborne and a note on "Australian Poetry, 1945" were published. Unfortunately the footnotes relating to these volumes were omitted. They are as follows.

"Essays and Studies", by W. A. Osborne; 1946. Melbourne, Sydney, Adelaide: Lothian Publishing Company Proprietary Limited. 8½" × 5½", pp. 196. Price: 10s. 6d.

"Australian Poetry, 1945", selected by Kenneth Slessor; 1946. Sydney, London: Angus and Robertson Limited. 7¼" × 4¾", pp. 90. Price: 4s. 6d.

[1] "Human Torulosis: A Clinical, Pathological and Microbiological Study with a Report of Thirteen Cases", by Leonard B. Cox, M.D. (Melbourne), M.R.C.P. (Edinburgh), F.R.A.C.P., and Jean C. Tolhurst, M.Sc. (Melbourne); 1946. Melbourne: Melbourne University Press. 9¾" × 7¼", pp. 161, with illustrations. Price: 25s.

The Medical Journal of Australia

SATURDAY, OCTOBER 19, 1946.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

PROGNOSIS.

In one of the articles published under the heading "In England Now" and described as "A Running Commentary by Peripatetic Correspondents" a story is told[1] of a surgeon, called in by the family doctor to see a woman who had an inoperable carcinoma of the breast which had not responded to X-ray therapy. The surgeon could make no suggestion about treatment and told the relatives that the prognosis was hopeless. He then saw the patient again. She said: "Doctor, I know what is going to happen to me, I am going to die." The surgeon replied: "Yes, probably, but I am not going to condemn you. Miracles still occur, though today we call them errors in diagnosis." This story is well suited to serve as an introduction to a discussion on prognosis, an aspect of medical practice in which every successful practitioner must be proficient. Diagnosis and treatment will probably be described as the most important branches of a practitioner's work, and it may be argued that if the doctor knows what is the matter with his patient and applies the correct remedy in such a way that the patient recovers, nothing else is of much moment. But a patient is not just a man with an ailment and recovery is not a matter of only passing, or shall we say academic, interest. He may have a wife, children or parents dependent on him, and they for a variety of reasons may be much concerned with the patient's future welfare. The patient himself may be a phlegmatic sort of person or he may be intensely alive and concerned with the purpose of life. Whatever he is, he will have an interest in his future. There must be very few people in the world who show no concern with either survival or death. A medical attendant may not always be asked for a prognosis, but when prognosis is required of him it is most necessary that his opinion should be well founded on fact and that his words should be wise. We can thus state a first conclusion—that the art of prognosis should be practised by the medical attendant in respect of every illness, whether a statement has to be made about the outcome of the illness or not. This conclusion justifies a discussion on prognosis from time to time, even as stock-taking in certain matters of diagnosis and treatment should be undertaken lest they be obscured by disuse.

In our last discussion on this subject in March, 1939, reference was made to an address by Professor J. A. Ryle, in which he defined prognosis as rational forecasting based on pathology and observational experience. Ryle points out that comfort and reassurance are universally accepted as essential contributions to progress and even to recovery. Anxiety in his opinion is the most prevalent of all the harmful emotions, and the best counter of anxiety is a good prognosis. Leslie Cole in a recent discussion on prognosis and the patient[1] makes three statements that appear to follow on Ryle's remarks. (i) Any illness brings with it anxiety in some degree. The amount of anxiety may depend more on the patient's temperament and environment than on the seriousness of his condition. (ii) Uncertainty increases this anxiety. (iii) To give a bad prognosis to the patient almost always does more harm than good. Cole states that for many patients, even when all possible laboratory and clinical data have been obtained, the prognosis is too vague to justify an emphatic pronouncement. In these circumstances he thinks that it is better to be non-committal than to box the compass of probabilities and possibilities. With this we may agree with the possible exception of cases in which an intelligent patient asks for a statement of probabilities and possibilities. In these circumstances an effort should be made to put the whole problem of the illness in its true perspective. Cole goes on to state that in other cases the prognosis is so bad that it would be cruel except in rare circumstances to be anything but reserved. Again we agree. The rare circumstances will be those in which the patient makes a direct question regarding facts; when this happens the truth should be stated. The "peripatetic correspondent's" surgeon who has been quoted added the final part of his last sentence in kindness. If the patient had asked, "Do you think that possibly a wrong diagnosis may have been made?", he would have had to reply in the negative without any hedging. The patient said that she knew she was going to die and the kindness of the surgeon's remark was justified. Cole has a third group of cases in which, after all those have been eliminated in which prognosis is too uncertain or too serious to help the patient, the prognosis is sufficiently definite and encouraging for it to be passed on. This fortunately is the largest group, and here the clinician should be as definite and as encouraging as possible. It is the group in which the art of prognosis can be perfected, the group in which the medical practitioner can often relieve his patient's anxiety and by so doing help him on his road to recovery.

Cole accuses himself of uttering a sequence of platitudes, but he must be acquitted of this charge. He has a point of view that will commend itself to readers. He points out that in history-taking it is often not difficult to trace backwards the sequence of pathological and environmental processes that have led to gross lesions; the gross lesion often, of course, is found in the post-mortem room. Prognosis in its widest sense is to Cole the reversal of this process. It is true that from a single uncorrected deviation

[1] *The Lancet*, January 5, 1946.

[1] *Ibidem.*

from normal it may be possible to foretell a series of probable effects, especially if knowledge of the deviation is combined with understanding of the patient's history, family history, environment and temperament. There are many roads on which a patient may travel, whether he is in search of health or unmindful of his well-being. Deviations are possible at any stage. Prognosis will be possible at any moment only in regard to the general direction of travel. As the direction becomes more definite, as major turnings are passed by one after another, a forecast is more easily made. When the road runs downhill an about-turn and a reascent are more difficult to make as time goes on. If we carry on with our metaphor we can realize that a general direction can be determined and deviations from it avoided. This means that prognosis is then bound up with preventive medicine. Preventive medicine may to a certain extent determine prognosis. When we realize that the factors on which a prognosis is based are the patient himself, the patient's environment and the disease, we can see how a discussion on the relationship between prognosis and preventive medicine could be elaborated. That is a matter for another occasion. Returning to prognosis alone, we note that every possible means must be used to reinforce the clinician's impressions. Such methods as radiological examinations, pathological tests, electrocardiographic tracings and so forth will be used; but too much reliance will not be placed on them. Cole reminds us that every technical advance in medicine has made it possible to demonstrate fresh variations within the limits of normal which would previously have passed unnoticed. Examples quoted by him are the benign systolic murmur revealed by the stethoscope, a slight degree of hypertension revealed by the sphygmomanometer, gastroptosis revealed by X-ray examination. To remember this is most important. We must go further, however, and remember that no hard and fast rule can be set down for many of the discoveries made on clinical or special examination, that what is abnormal in one person may be normal in another. Discrimination becomes possible with experience and judgement. Experience will also impress on the clinician the unwisdom of allowing the patient to know the results of special methods of examination—the patient must always be prevented from acquiring any knowledge which in his unstable moments may serve as the basis of a neurosis. But that takes us into another side track. The last word in this discussion must be concerned with Cole's third group of cases in which the prognosis is sufficiently definite and encouraging for it to be passed on. It should be clear that to withhold a good prognosis from a patient is to do him an injustice. To this we may add the statement that if the clinician is in doubt he should err on the side of optimism, for optimism, as someone has said, is a heart stimulant.

Current Comment.

THE ABSORPTION OF SALICYLATES.

The renascence of interest in the treatment of acute rheumatism by salicylates has emphasized the importance of securing an efficient dose of the drug. Whether salicylates are true specifics or not we cannot settle at present, but there is no doubt about their therapeutic importance. Since the estimation of drug levels in the body fluids has become an accepted procedure, much more attention has been paid to the answering of the simple question, whether the patient really swallowed the dose or not. An article has been published dealing with the absorption of salicylates, with particular reference to the attaining of a serum salicylate level of 20 to 30 milligrammes *per centum* or higher, considered by Coburn to be critical. R. W. Huntington, R. D. Ryan, H. R. Butt, G. C. Griffith, H. Montgomery, R. F. Solley and W. H. Leake have described their findings in series of experiments carried out on volunteers and the subjects of rheumatic fever.[1] The drug was administered by the oral route in the form of tablets and in some cases was given intravenously. A trial was also made of the rectal route, a solution of 50 grains of sodium salicylate being used in an ounce of water, the solution being retained for two hours. It was established that a blood level of 19 milligrammes *per centum* is quickly attained in the normal volunteer. This level was not affected by the giving of an equal amount of sodium bicarbonate. Rectal administration was not successful in producing an adequate serum level. In studies on rheumatic subjects who showed a moderately high level of salicylate in the blood it was observed that a test dose, whether given by the oral or the intravenous route, did not raise the level much. In the case of some subjects there was a lower blood level of the drug than was expected, and the reason for this was naturally of importance. In this connexion the toxic symptoms of the drug may be mentioned. These authors describe these as typical: nausea, light-headedness, garrulity and irresponsibility similar to those observed with alcohol. One of the team checked this description by personal experience. It is noted, however, that one of the subjects commented on the difference in the psychic state from which the exhilaration following the ingestion of alcohol was conspicuously absent. It was concluded that not only was salicylate of soda unpleasant to take, but it also begot a state of irresponsibility, in which presumably the failure to take prescribed treatment or to cooperate with a scientific experiment seemed not only a venial offence but even a worthy act. More practical is the authors' finding that fluctuations in the serum concentrations varied with the experience and efficiency of the nursing staff. Even when the patients understood that it was important that they should be obedient, there was a tendency in some of them to become less cooperative after several weeks. Whether it can be seriously contended that the toxic effects of the drug are relevant in this connexion or not, there is no doubt that it is most important that all care be taken to see that treatment ordered is carried out. Even under military discipline experimental work involving the administration of drugs needs careful safeguards.

The conclusions reached in this article are that absorption of salicylates from the upper part of the gastro-intestinal tract is prompt and that intravenous administration should only seldom be necessary. The giving of sodium bicarbonate simultaneously does not substantially interfere with the level of the drug in the blood. This work serves to confirm established views and encourages the belief that apparent irregularities of absorption are usually in fact due to lack of faithfulness in taking the drug. Readers of Kipling may remember how the old Sahiba stood over Kim till her pestilential drenches went down and inquired exhaustively about them when they came up. At least the old lady had a quality still valuable in nurses and doctors, that of being sure that the patient is really doing as he is bid.

THE BLOOD SEDIMENTATION RATE.

It is occasionally a good thing to take stock, and medical journals can perform a useful function in reviewing a subject without attempting to add new facts. One has a suspicion that even some of those intellectually robust souls who seem to scorn medical writings except they

[1] *Annals of Internal Medicine*, June, 1946.

are original might be found now and then quietly reading symposia. A very useful symposium on the blood sedimentation rate has been published recently in *The Practitioner* for July, 1946. R. G. McFarlane and J. R. O'Brien deal with the rationale of the test. Theirs is not an easy task, for the number of variable factors involved is almost as great as the number of methods of performing the test devised by ingenious laboratory enthusiasts. It is true, as they remark, that the tendency of modern medicine is to seek numerical results which may state a comparison more clearly than mere clinical impressions. They make a good point when they place the sedimentation rate in a category which includes the body temperature and the leucocyte count. All are affected by many different conditions and all are independent. They show that something may be wrong, but not what is wrong, if anything. Perhaps then we may agree that the mathematical literature on the subject may be conceded to have academic elegance rather than practical value. It is obvious that the rate at which the red cells will sink in plasma is a matter of the weight of the cells against the resistance of the plasma. Rouleaux formation seems rather to be due to causes in the fluid than in the floating cells, and for a time it was thought that the fibrinogen level was the most important factor. Now, however, it is believed that the balance beween active and inhibitory proteins, fibrinogen being the more important of the former, is the determinant of the sedimentation rate. But at the bedside this does not matter much provided the test is technically reliable and provided it can be interpreted in terms of diagnosis or prognosis. McFarlane and O'Brien deal with the chief technical factors and the method of recording the result, and naturally emphasize the most significant disturbing element, that is, the number of red cells in the unit volume of blood. Anæmia will upset the figures considerably; it is necessary to make correction for substantial anæmia, and naturally it is essential to know if any exists. The methods of making the test are dealt with by J. M. Alston, who deals with the details of withdrawal of blood, mixing it with the coagulant, and the other various points of technique. He also describes briefly the usual methods: the simple long tube of Westergren, with its single reading; the Wintrobe tube, which permits hæmatocrit readings to be made with the same material; and the more elaborate methods of Linzenmeier and Cutler. L. J. Davis, in discussing this test from the standpoint of a critical clinical survey, also speaks of these different methods, and on the whole prefers the Westergren and is inclined to offset the need for a correction for anæmia especially if this technique is used. He advises that slight raising of the figures, particularly for one reading only, are to be accepted with great caution, but gives the verdict as most would give it today, that the test is of considerable value if interpreted with its limitations in mind. It is not necessary to traverse all the conditions in which it has been used, but it is of interest to quote the opinions of three authorities as to its value in pulmonary tuberculosis, rheumatoid arthritis and rheumatic fever. G. S. Todd, writing from the King Edward VII Sanatorium, states that the sedimentation rate if properly used can be of great value in the treatment of pulmonary tuberculosis, but an isolated reading can do great harm. H. J. Gibson, of Bath, finds the test of value in estimating the progress of patients under treatment for rheumatoid arthritis and the ankylosing form of spondylitis, remarking truly that it is evidence which is free from bias. He points out too that in these groups of chronic rheumatic disease the rate is raised, whereas in the fibrositic and osteoarthritic groups it is within normal limits. Bernard Schlesinger finds that it is frequently helpful in rheumatic fever, though it must be interpreted with full understanding of the various episodes and developments which may interrupt the patient's progress in this long and recurrent disease.

These articles summarize the position well; they are neither too technical nor too enthusiastic. After a period of devotion to more complicated methods of technique and appraisal it seems now to be recognized by clinicians that there is a great deal of help to be obtained from this method of investigation. The degree of this help will largely depend upon the realization that a simple test, like the original Westergren, repeated at intervals, can be made very useful if it is regarded as part of a collection of clinical data and not looked on with too myopic an eye.

THE SPLEEN AND BLOOD COAGULATION.

For the proper discussion of coagulation of the blood time and space are required. In the present instance it is desired to refer only to the spleen and its effect upon disorders of coagulation. In cases of thrombocytopenia, when bleeding recurs, splenectomy is often followed by remission, though this does not always last. The changes produced in the blood state by splenectomy are variable also, and improvement does not always run parallel with increase in the number of thrombocytes in the circulating blood. It is in fact generally recognized that in thrombocytopenic purpura there may be other factors as well as a deficiency of platelets in the production of purpuric manifestations. E. R. Trethewie, who has carried out previous researches in blood coagulation, has recently published some work on the effect of the spleen in altering the coagulability of the blood.[1] These experiments have been performed on dogs, the spleen being excised and used for perfusion procedures. It was found that if the excised organ was immersed in a bath of Tyrode's solution bubbled with carbon dioxide and oxygen, its size could be kept constant. The blood for perfusion was obtained from the animal's own circulation and diluted, and heparin was added. Samples of the fluid before and after the experiments were used to assess clotting over a period of twenty-four hours, and counts of the red blood cells and platelets were also made. By comparing the specimens of perfused blood with controls it was possible to determine any change in the coagulability of the fluid, and further useful information was gained in evaluation of results by estimating the content of heparin and prothrombin. Trethewie concludes that the spleen confers an anticoagulant property on diluted blood as this passes through it. It was possible to adjust the amount of heparin in the fluid so that coagulation was inhibited by the action of the spleen, though it occurred in normal controls. The anticoagulant effect was not due to prothrombin, as no alteration in the prothrombin content of the perfused fluid was found. Further, it was not due to alterations in the number of platelets, so the author concludes that there is some anticoagulant effect exerted by the spleen which is not accounted for by the factors mentioned. It is suggested that this may possibly be responsible for certain conditions in which bleeding occurs, which are not related to a deficit of platelets.

Though the subject of intravascular clotting is not directly related to the topic under discussion at present, it may be pointed out that Trethewie has also published some work on the coagulability of blood after perfusion through the lower extremities and pelvic organs.[2] By the use of a similar technique it has been shown that diluted blood thus perfused in a laboratory animal contains an increased amount of a coagulant substance, possibly prothrombin, after passing through the lower extremities. This is interesting, because passage through most organs either reduces the amount of coagulants or leaves them unchanged, and the possible bearing on the occurrence of clotting in the pelvic and iliac veins, especially in surgical practice, is at once suggested.

This work is of course only contributory to a mass of observations being collected on the subject of blood coagulation in health and disease. Its value is not only in the filling in of blanks in knowledge, but also in emphasizing that in the clinical problems of disturbed blood coagulation the approach should be individual in each case and, as far as possible, physiological.

[1] *The Australian and New Zealand Journal of Surgery*, April, 1946.
[2] *Ibidem.*

Abstracts from Medical Literature.

OPHTHALMOLOGY.

The Possible Influence of the Hypophysis in Glaucoma.

G. E. JAYLE AND M. SCHACHTER (*La presse médicale*, January 26, 1946) suggest that glaucoma may be associated with a pituitary disorder as a result of a statistical study of the blood pressure in this disease. They recall previous observations of changes in the intraocular tension occurring in pregnancy and also in chromophobe adenoma, Fröhlich's syndrome and other pituitary disorders.

Gerontology.

C. W. RUTHERFORD (*Journal of Indiana State Medical Association*, May, 1946) takes up the cudgels on behalf of the aged. Osler is said to have remarked that the history of the world would not have been materially altered if everybody had been chloroformed in middle life. Rice for a decade has been expounding the creed of "adding life to your years—not years to your life". The ocular characteristics of old age arise from two related processes: (*a*) histological changes occur in vascular tissue leading to impaired nutrition of the dependent structures; (*b*) the individual becomes deficient in fat-soluble vitamins. The fat content of the orbit and subcutaneous tissues is reduced by migration and redistribution of fat. The globe recedes in position. The eyebrows and lashes become grey. The lids lose support, so that ptosis, entropion and ectropion develop. The cornea becomes dull and *arcus senilis* appears. The conjunctiva is tinted yellow. The iris may develop atrophic patches. The anterior chamber is shallow and the lens takes on a grey or brownish hue. The tendency to take weaker convex lenses and to read without them beguiles the patient into believing in rejuvenation of sight, whereas actually it presages cataract. Vitreous opacities may cause worry. Glaucoma becomes the greatest cause of blindness in this age group. Later in life macular degeneration takes first place. Much of all this cannot be cured and must be endured. The role of the tactful physician is largely to aid a philosophical adjustment of the patient to his less active role in life. The senile person is justified in demanding care equal to that of the infant.

Acute Glaucoma.

M. J. ICAZA (*Archives of Ophthalmology*, April, 1946) has tried to solve a vexatious problem—what to do in a case of acute glaucoma when the condition does not respond to miotics and in which sudden decompression may cause intraocular hæmorrhage. For many years it has been known that retrobulbar injections of "Novocain" cause softening of the eye. It has also been notorious that in acute glaucoma not only miotics but local anæsthetics may fail to relieve pain or lower the tension and morphine has to be given. If operation is performed on the acutely inflamed eye there is grave danger of the occurrence of severe hæmorrhage and even posterior sclerotomy is not an ideal preliminary. If operation is postponed until the eye is quiet it may be too late to save any useful sight. The author begins by instilling eserine (0·5% solution) and pilocarpine (1%). This prevents the dilatation of the pupil which invariably follows retrobulbar anæsthesia. He then gives a retrobulbar injection of 1·0 millilitre of a 2% solution of "Novocain" or "Procaine" with a little epinephrine in saline solution. This solution infiltrates the retrobulbar tissues. The "Novocain" blocks all the sensory nerves to the eye, stopping pain at once. The epinephrine causes strong constriction of the ciliary vessels and the resulting anæmia diminishes the volume of the iris and ciliary body and lowers the tension. The tension having fallen, miotics are absorbed through the cornea and constrict the pupil. The tension then remains low and the eye becomes quiet and can be operated on days or weeks later. This procedure has been used successfully in over 200 cases and is now a routine measure. It fulfils the two most urgent needs in an acute attack of glaucoma, deadening the unbearable pain and lessening the tension sufficiently to make operation safe.

Kerato-conjunctivitis Associated with Skin Lesion.

W. J. O'DONOVAN AND I. C. MICHAELSON (*The British Journal of Ophthalmology*, April, 1946), during one year, saw 66 patients suffering from kerato-conjunctivitis. Half of these had a concurrent affection of the skin. Eighteen of the 33 had seborrhœic dermatitis. In all cases in which the skin was involved the scalp or face was affected and there was a strong tendency for skin and eye lesions to be ipsilateral. In the majority of cases the onset of the skin lesions preceded that of the ocular lesion by a short but definite interval of time. After detailed consideration of the clinical phenomena in cases in which skin lesions were and were not present, it is suggested that kerato-conjunctivitis with skin lesions is indistinguishable from epidemic virus kerato-conjunctivitis. Penicillin diminished the discharge in cases in which mixed infection occurred, but had no influence on the corneal lesions. An analogy has been suggested between the skin lesions present in some cases of epidemic kerato-conjunctivitis and those present in two other virus infections of the conjunctiva and cornea, *herpes simplex* and *herpes zoster*.

Ophthalmic Problems and Visual Standards in Industry.

JOSEPH MINTON (*The British Journal of Ophthalmology*, May, 1946) attempts to elucidate some of the principles which may guide industrial medical officers in the selection of employees for various jobs in industry. The author suggests five grades of vision. Grade I vision includes all persons possessing $^6/_6$ or $^6/_9$ vision in each eye and those having $^6/_6$ in one eye and not less than $^6/_{36}$ in the other. These individuals are fit for all occupations. Grade II vision includes all those possessing vision not less than $^6/_{12}$ in each eye and also those having $^6/_{12}$ in one eye and not less than $^6/_{36}$ in the other eye. They are fit for all work except for very close work. Grade III vision includes all one-eyed people who have $^6/_6$, $^6/_9$ or $^6/_{12}$ vision in the good eye and less than $^6/_{36}$ in the other eye or who have one blind eye. One-eyed persons with $^6/_6$ vision are fit for all occupations. Persons with $^6/_9$ or $^6/_{12}$ vision in the good eye can be engaged in most industries. These people should not be used in industry where there is danger to the good eye. Grade IV vision includes people with $^6/_{24}$ vision in each eye or $^6/_{24}$ in one eye and $^6/_{36}$ in the other eye. They may be employed in all outdoor occupations, building trades, carpentry, dock labouring. Grade V vision includes the blind and partially blind and also all individuals with less than $^6/_{36}$ vision in each eye. The blind and partially blind can be gainfully employed as outlined in a pamphlet issued by the National Institute for the Blind. High intelligence and experience often counterbalance the handicaps which arise from poor visual acuity. Fine work at close range requires constant effort of accommodation and convergence to a greater degree than does ordinary clerical work. Persons doing such work who suffer from eyestrain may often be relieved by wearing spectacles with strong prisms which have the base in. Employees with phorias greater than five prism diopters should not be put on fine close work. There is no evidence that close work has any effect on the progress of myopia. Existence of latent hypermetropia is important, for although uncorrected vision may be $^6/_6$ when a person enters a service, at forty years of age the latent hypermetropia becomes manifest and uncorrected vision drops to $^6/_{18}$. Promotion of such an individual may now be refused on the ground that uncorrected vision is below standard and so a man's life work goes unrewarded.

Atopic Cataract.

F. C. CORDES AND R. CORDERO-MORENO (*American Journal of Ophthalmology*, April, 1946) report four cases of atopic cataract. Atopy is defined as the condition of being sensitive to an allergen. It has been used to express the unusual hereditary tendency of some individuals to develop severe reactions to certain common protein materials, the reaction being accompanied by hay fever, asthma and eczema. These cataracts are associated with a neurodermatitis which is characterized by pruritus associated with lichenification and shows a typical distribution. While there is a good deal of discussion as to the cause of the dermatitis and the causative factors must still be considered unsettled, the tendency in America is to accept the allergic theory and the term atopic dermatitis. What is considered a typical form of atopic cataract is the formation of a white milky plaque in the pupillary area which may be localized in the region either of the anterior or of the posterior pole of the lens, involving superficial layers of the lens cortex. Early changes are granular deposits in the anterior capsule and an increase in prominence of the Y-suture lines. Beetham states that there are two types. The first is the typical and commonly seen complicated cataract which begins at the posterior pole with increased iridescence, vacuoles and precipitates. Striation and small punctate opacities are often present. Anterior cortex beneath the lens capsule is soon involved. The second type is a dense, irregular, opaque plaque in the pupillary area beneath the anterior lens capsule; in 30% to 50% the plaques are

unilateral. Age incidence is highest in puberty and young adult life; sex has no influence. The mechanism of the formation of lens opacities is uncertain; the authors favour the theory of the atopic shock organ, the patient having organs or fissures wherein his allergy is manifested. The treatment in these cases is surgical.

Further Studies on the Use of "Furmethide" in the Treatment of Glaucoma.

E. U. OWENS AND A. C. WOODS (*American Journal of Ophthalmology*, April, 1946) present results of treatment of glaucoma with "Furmethide". They have to date investigated the use of the drug in the treatment of 106 patients, 65 of whom had primary glaucoma and 41 of whom had secondary glaucoma. In the primary group the tension was over 55 millimetres of mercury (Schiotz) in the case of 62% of patients and between 40 and 55 millimetres in the remaining 38%. The tension was reduced to 35 millimetres or less in the case of 75% of the patients whose initial tension was over 55 millimetres and in 80% of those in which the initial tension was between 40 and 55 millimetres. Cases are further classified into early and late, the former being those in which field defect was less than 30° in any meridian and the blind spot was not enlarged more than 10° in any diameter. Accordingly 30% of the cases were early and 70% late; the tension was reduced to 35 millimetres or less in 79% of early cases and in 67% of late cases. In secondary glaucoma the drug reduced tension to 35 millimetres or less in 59% of cases, excluding nine cases due to venous thrombosis in which the drug was ineffectual. The drug was instilled into the conjunctival sac every fifteen minutes for two hours, then every three hours until ocular tension was reduced to normal or until operation was undertaken. A 10% solution was used. The drug was equally efficacious in treatment when other miotics had failed.

OTO-RHINO-LARYNGOLOGY.

The Use of Radium in Aerotitis Control.

A STANDARDIZED form of radium treatment for the control of lymphoid hypertrophy about the pharyngeal ostium of the Eustachian tube was employed in the United States Air Forces and the results have been evaluated by officers specially instructed in the procedure (*The Annals of Otology, Rhinology and Laryngology*, December, 1945). The technique was that developed by Dr. S. J. Crowe, of the Johns Hopkins Hospital. Two radium applicators are used simultaneously, one through each nostril. The radium-containing chamber at the inner end is of "Monel" metal, 2·0 centimetres long, with an outside diameter of 2·3 millimetres, an inside diameter of 1·7 millimetre and a wall thickness of 0·3 millimetre. Fifty milligrammes of radium sulphate are used in each container. The application takes 6·6 to 8·5 minutes, giving a dose of one gramme in twenty seconds to one gramme in twenty-five seconds. As a rule a course of three or four treatments is given at intervals of not less than twenty-five to thirty days. Treatments should not be given if the patient has an acute upper respiratory infection. In the presence of subacute nasopharyngitis one-half of the usual dose may be given and the other half five days later. The full dose at one sitting is always more effective, however, than the same dosage given in fractional amounts over a period of one week. There is variation in the individual response to radium. There was rarely more than a mild coryza-like after-reaction to each application. As 14,045 individual treatments were given, those operating the treatment clinics were required to take careful routine measures for protection against the effects of irradiation upon themselves. In no instance were any harmful effects observed among those treated; but it is thought that with the applicator and amount of radium as specified, 8·5 minutes is the maximum time that can be safely allowed for each application. In the United States, week after week, the year round, aerotitis headed the list of disorders due to flying. At Mitchel Field, of 1,000 bomber crew members 31·5% had hyperplastic lymphoid tissue about the Eustachian tube orifices. A striking correlation was found between the amount of lymphoid tissue around the tubal orifice and the incidence of aerotitis. The naso-pharyngoscope was used by all examiners to determine the condition about the Eustachian orifices and a diagrammatic sketch was made for future comparison. In the five air forces concerned 636 men with a positive history of ear-ventilating difficulty were available for examination thirty days after their second and third treatments. Objective and subjective improvement in these men was noted after the second treatment and was even more apparent after the third. It was noted in each individually operating clinic that the subjective improvement as reported by the flier paralleled objective improvements as observed by the medical officer. At one training area the aerotitis rate in a group of 778 men selected for prophylactic irradiation on account of lymphoid hypertrophies was twice that of a control group of 992 men with clear tubal orifices. After treatments were complete, the rates per 100 flights in the treated and control groups were practically identical. In each of the other groups reporting results, over 80% of fliers reported subjective improvements and objective improvements were observed in over 90%. Analysis of those who failed to benefit from treatment often revealed large masses of lymphoid tissue calling for surgical removal, or such other factors as allergy, chronic sinusitis or hypertrophy of the posterior ends of the inferior turbinates.

Corrosive Injuries of the Œsophagus.

TRULS LEEGAARD (*The Journal of Laryngology and Otology*, October, 1945) states that at the Rikshospital, Oslo, Norway, an average of 23 or 24 patients suffering from lye poisoning were admitted each year for the six years preceding 1899. The majority were children who had accidentally swallowed the corrosive poison. Twenty-nine patients were treated at the same institution during the ten-year period from 1933 to 1942, the reduced numbers being due to education of the public and to improved regulations controlling the sale and keeping of such injurious substances. Since 1944 there has been an increase again in the numbers, a total of 52 patients being treated in the next two years. The great number of cases has forced a review of the mode of treatment of the affliction. Severe pain, toxic symptoms and generalized exhaustion may have to be dealt with first. Early death may occur in cases of severe corrosion, while purulent œsophagitis, mediastinitis, pericarditis and *empyema thoracis* may arise from infection and rupture of the viscus. Stricture formation later endangers the patient, owing to the poor state of nutrition which it may induce and on account of the hazards of attempted dilatation. In spite of the apparent dangers of perforation of the corroded viscus, it is essential to begin treatment before scar formation has begun to produce a stricture, rather than to wait three or four weeks in the hope that by that time all ulceration may have healed. When this period has been allowed to elapse before interference, it has been observed that more than half of such patients develop extensive strictures and the remainder small strictures. The risk of early treatment does not appear to be great. On the basis of investigations of morbid pathology, Belinoff considered that careful œsophagoscopy and then treatment with bougies should begin after seven to ten days, as collagen fibres which are the basis of scar tissue first appear at the beginning of the second week. Daily instrumentation, however, may be dangerous. Where rest of the viscus seems necessary a retained catheter is to be used. This should not be so thick that it exerts any pressure on the œsophageal wall. The catheter, which passes out through the nose, is moved twice a week and changed once a week. The very presence of a rubber catheter appears to cause some dilatation around it. The method of management of 34 patients with recent lye injuries of the œsophagus is reviewed by the author. Following Belinoff's routine, he performs œsophagoscopy after one week, using light local anæsthesia, or in the case of small children, ether anæsthesia or no anæsthesia at all. After this, for a period of four to six weeks, bougies were passed every day and retained for twenty to thirty minutes, and after that once a week for about six months. Subsequently the patients were controlled at not too long intervals for several years. In the more serious cases with deep corrosion, external œsophagotomy was found to be wise; it was performed in six of ten such cases. A catheter is introduced through the external opening. This catheter is first left undisturbed for ten days, and after that it is changed once a week, the size being gradually increased. The dressings require daily renewal. The fistula closes spontaneously when no longer used. In the case of very young children, the rubber catheter, if passed in through the nose, may be left *in situ* for several weeks at a time, the treatment being continued for about eight weeks. For established strictures dilatation with bougies is almost the only method available; this may have to include gastrostomy and retrograde instrumentation, and a tube may have to be retained for some time, passing out either via the nares or through an external œsophagotomy opening.

Congresses.

THE AUSTRALIAN AND NEW ZEALAND ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE twenty-fifth meeting of the Australian and New Zealand Association for the Advancement of Science was held in Adelaide from August 21 to 28, 1946, under the presidency of Dr. P. Marshall (New Zealand).

The Sections.

The sections represented were: *A*, Astronomy, Mathematics, Physics and Optometry; *B*, Chemistry; *C*, Geology; *D*, Zoology; *E*, History; *F*, Anthropology and Speech Sciences; *G*, Economics, Statistics and Social Science; *H*, Engineering and Architecture; *I*, Medical Science and National Health; *J*, Education, Psychology and Philosophy; *K*, Agriculture and Forestry; *L*, Veterinary Science; *M*, Botany; *N*, Physiology; *O*, Pharmaceutical Science; *P*, Geography and Oceanography.

General Council Meeting.

At a general council meeting held on August 21, 1946, the association accepted an invitation to hold its next meeting in Perth in August next year.

Dr. A. E. V. Richardson, chief executive officer of the Council for Scientific and Industrial Research, was elected president-elect for the next meeting of the association. Dr. A. B. Walkom, director of the Australian Museum in Sydney, was reelected general secretary, and Dr. J. R. A. McMillan, of the Commonwealth Department of Commerce and Agriculture, was elected treasurer.

Mueller memorial medals were awarded to Mr. C. T. White, the Queensland Government Botanist, and Mr. E. C. Andrews, former Government Geologist for New South Wales. These awards were made for research on the systematic botany of Queensland and the physiography and structural ecology of Australia respectively.

Reception of Delegates.

The members of the association were entertained by the South Australian Committee of the Association at an afternoon party in the University Refectory on Wednesday, August 21. Guests were received by Sir Douglas Mawson, Chairman of the South Australian Committee, with the President of the Congress, Dr. P. Marshall. On Thursday, August 22, an evening reception for interstate members was given by the South Australian University Graduates' Union and the University Wives' Club. His Excellency the Governor (Sir Willoughby Norrie) was present at a reception for members of the Congress held by the Government of South Australia in the National Gallery on the evening of Tuesday, August 27. The Acting Lord Mayor (Alderman T. H. Grundy) welcomed the delegates at a civic reception at the Adelaide Town Hall on Wednesday, August 21.

Inaugural Meeting and Presidential Address.

The inaugural meeting was held in the Bonython Hall of the University of Adelaide on the evening of Wednesday, August 21. The delegates were welcomed by His Excellency the Governor of South Australia, Sir Willoughby Norrie. In his address, the Governor said that he was certain that the intimate collaboration of the whole Empire in scientific matters was a goal towards which the congress would be a major step. Science had not been resting during the war; indeed, many would say that it had been only too active. An important part of the work of the congress would be to hear of and to discuss the advances which had been made during the war. He hoped that scientists would be able to forecast the direction of progress in the future, when science might promote the arts of peace as much as it had changed the weapons of war. The association had been without a president since the death of Sir Ernest Scott and Sir Willoughby Norrie expressed pleasure in welcoming the new president. He said that Dr. Marshall had long been associated with higher education and geology in New Zealand.

The newly-elected president, Dr. Patrick Marshall, Geological Consultant to the Government of New Zealand and formerly Professor of Geology in the University of Otago, then delivered his address on "The Permanent Pacific".

He said that opinion had differed much in regard to the origin and age of the Pacific Ocean. Many who had studied the subject thought that its size and shape had changed very materially from age to age. The first question that arose was the actual boundary of the Pacific basin. On the eastern side the two American continents were a definite and obvious limit of the great ocean basin. On the western side the boundary was not shown so clearly.

When the ocean surroundings that had been made were analysed it became clear that in the south the continuous deep water area followed the line of islands from New Zealand, Tonga, Fiji, New Hebrides and onward to the Japanese Islands, then through the Kuriles to join with the line of the Aleutian Islands. Within this broken line of islands the ocean water was seldom of great depth and changed rapidly from point to point. Outside the line of islands the ocean depth was of uniform profundity. On this line these islands had a somewhat similar structure, the older rocks were crushed and broken and frequently there were active volcanoes situated on it.

It was also a zone in which seismic action was very pronounced. Nearly all the earthquakes of the western Pacific originated on this line. There were some six small areas on the line which had most exceptional seismicity. Along this zone, too, there had been many and extreme movements of elevations and depression. Practically all physical conditions combined to indicate that this border of the ocean was one of great instability. It had lately been shown that earthquake vibrations traversed the ocean floor with greater rapidity than they traversed the rocks of continents. This proved that the rock material of which the ocean floor was formed was of denser and heavier material than that of which the continents were composed. There was every reason to think that this was an original character of the floor of the Pacific Ocean.

The small islands in the deep ocean were volcanic in origin and their weight was causing them to sink gradually to a position of rest. This sinking might reasonably explain the peculiar form of barrier coral reefs and egatolls. The very many peculiar species of animal and plant life in the ocean islands were illustrated by some striking examples. Emphasis was laid on the fact that 81% of the flowering plants of Hawaii were peculiar to that island and in New Zealand the percentage was 71. In the islands there were no snakes and very few other reptiles, while land birds too were few and were often different in islands that were relatively close to one another.

The extinct species of the moa and the peculiarity of many of the existing birds of New Zealand indicated that these islands had been isolated for an immense lapse of time.

The peculiarity of the Maori people of New Zealand and the mystery of the exact origin of the Polynesians showed the great difficulty that was encountered in explaining the dispersion of organisms over the Pacific Ocean.

Thus for many reasons it would seem that the great ocean was an original feature of the earth's surface and that throughout the world's history this isolation had been maintained.

Opportunity in the Antarctic.

Sir Douglas Mawson (Adelaide) showed a film of the 1929-1931 British-Australian-New Zealand Antarctic Research Expedition, and gave an address on opportunities in the Antarctic. He said that whaling operations in the Antarctic had been extremely lucrative, even under war conditions, and that now that active hostilities had ceased, Australia should once more show interest in her geographical inheritance in Antarctica. It was imperative too that the number of permits for whaling factory ships to operate in the Antarctic waters should always be severely restricted in order to preserve the whale population.

Steps should be taken to inaugurate further explorations of a purely scientific nature.

Public Meeting.

"Where are We Going?"

On the eveing of Monday, August 26, a symposium on the subject "Where are We Going?" was held in the Bonython Hall at the University of Adelaide. The speakers were: Mr. R. van der Riet Woolley, Director of the Solar Observatory at Mount Stromlo, Professor S. M. Wadham, Professor of Agriculture at the University of Melbourne, Professor E. Ashby, Professor of Botany at the University of Sydney, Mr. L. G. Melville, Economist to the Commonwealth Bank, Professor R. M. Crawford, Professor of History at the University of Melbourne, who was also President of the Victorian division of the Council for Encouragement of Music and the arts and recently had spent a year in the Soviet Republic, and Mr. J. R. Darling, Headmaster of Geelong Grammar School.

The Chancellor of the University (Sir William Mitchell) in his opening remarks said that the symposium was the first stage of an experiment which it was hoped to continue at later meetings of the association. As a rule the public lecture had been given by one man for one hour. The excellent idea of a symposium had come from Professor L. F. Giblin, who introduced the six speakers.

Dr. Woolley said that his really serious rival in making predictions in the field of physical science had come not to this congress, but to the last one. He referred to Mr. H. G. Wells, who predicted many of the strange advances in the field of destructiveness on the one hand and gadgetry on the other, which had been made possible by advances in physics and engineering. He said that no imagined power over the forces of nature now seemed impossible of man's attainment—at all events outside the attainment of a great and powerful nation frightened by the threat of losing a war. The question whether nuclear reactions would provide the power of the future might turn out to be an economic rather than a technical matter. He stressed the immense cost of atomic energy at present as compared with other sources of power. The future did not look very bright if we were to have another war, and the Wellsian prophecy of a collapse of civilization—of another dark age—appeared a possibility which would be averted only if the leaders of mankind behaved much more sensibly in the second half of this century than they had done in the first. Dr. Woolley hoped that where they were going in physics was to an even more satisfactory understanding of nature.

Professor E. Ashby said that one major social problem indicated which way they were going. That problem was how to combine knowledge and power in democratic countries. The policy of education had not taken the people far enough. The political set-up was such that often instead of the very wisest person being in the Government, he was the lowest common denominator. The separation of power and knowledge formed the greatest danger and would remain so for some time to come. A tentative solution had been to surround the rulers with large bodies of scientific advisers, but this had not been a complete success. Professor Ashby suggested two ways of overcoming this difficulty. The first was to let scientists themselves take a hand in the government; he thought this would be a calamity. The second was to educate the people in the use of science in government, in particular, to provide higher education—and that swiftly—for all public servants. Only in this way could knowledge be combined with power in democratic government. If man could achieve this object the future might be bright. If not, it seemed inevitable that the power and liberty for which wars had been fought might become dead sea fruit.

Discussing the lag of economic theory behind events, Mr. L. G. Melville said that economists, no less than other people, disliked discarding an apparatus of thought they had built up slowly and laboriously. At times the lag became so great that revolutions in economic thought were needed. It was, however, not only economists and economic theory that lagged behind a changing world. Statesmen and practical men of affairs usually had a social philosophy which they had absorbed in their formative years and which was no longer applicable to current events. One heard technical experts at international conferences and elsewhere expounding theories which had become doubtful or even been discarded as untenable. These were the men who drew up the plans that were to govern the economic and social future. Almost inevitably they drew up plans designed to overcome the last crises rather than the next. Institutions, Mr. Melville suggested, lagged even further behind events than men and ideas. All this confusion of lagging theory of social science, out of touch statesmen and practical men of affairs, and defective and anachronistic institutions gave the ordinary man a sense of frustration. The question to be faced was, should theories, policies, institutions and group ideas be adapted to the needs of the atomic age? Mr. Melville thought that the lag in the ideas of governments and their advisers might be overcome by a close enough integration of the universities and the advisers to governments.

Professor S. M. Wadham spoke of the outlook with regard to agriculture and the application of agriculture to industry. Interesting developments in the wool industry were to be expected. The wool programme should give very important results in connexion with the breeding of sheep. A second step forward which Professor Wadham hoped would occur was a growing knowledge of the value of nutrition for animals. The question of human nutrition might be of great significance to the agriculture of this and other countries, in that it would mean a much larger demand for protective foods.

Professor R. M. Crawford said that historians could not test their conclusions like scientists, but could only go by certain formulas of generalization. Like scientists, historians found that changes occurred when environment varied. The study of history could become and was becoming less inexact than it had been and was providing a valuable aid in the study of human behaviour. Professor Crawford made a strong plea for the provision of grants for research in history.

Mr. J. R. Darling spoke about the future of education, saying that the ultimate aim of education was character rather than the mere acquisition of knowledge. He said that the general popularity of the idea of more education was coupled with an almost equivalent ignorance of the method or direction which education should take. The major problem was to assure that boys and girls received a training in the qualities which would fit them to live worthily in their status as human beings and make them determinedly capable of creating a free society. To do this required first of all teachers who were themselves educated and fit for a life in a free society and were clear in their own minds about what their main objectives were. The first essential to progress was that more of the best brains in the community should recognize that the profession of school-mastering was second only to that of the Church in its function of leading mankind out of the doubts in which it was involved. In considering the function of the school, people were liable to forget the other instruments of education, so powerfully and for the most part so irresponsibly and disastrously wielded. It was the responsibility of society to protect itself against these forces not by suppression or control but by competition. This could be done he suggested by the subsidizing of weekly or even daily newspapers. The extension of broadcasting services, the encouragement and subsidization of the theatre, of music and of films, particularly films for children. Libraries, community centres with facilities for club life and the development of bodily and mental facilities were the logical conclusion of any sensible educational system. The school itself could and should be linked with the development of such projects.

In conclusion, Mr. Darling thought that the world suffered from lack of faith rather than from lack of knowledge, though it was depressingly ignorant of the bases of its civilization. It was only by sitting at the feet of teachers, who themselves had faith, that students would develop the qualities that would enable them to find a faith of their own.

The Liversidge Memorial Lecture.

The title of the Liversidge Memorial Lecture, delivered by Dr. Adrien Albert (Sydney) was: "What can Chemistry Contribute to the Mastery of Disease?"

He said that this year marked the centenary of the birth of Professor Archibald Liversidge. It was indeed a fortunate thing that it had been possible to resume the orderly sequence of the conferences in time to honour Liversidge's memory. That 1,500 scientists—Australian and New Zealand—had been able to confer with one another in Adelaide was in itself a tribute to the vision and organizing ability of this man, the chief founder of the Association. But Liversidge had been much more than an organizer, he had been an enthusiast for research and moreover he had done everything in his power to encourage lectures describing research and suggesting in what direction it would be profitable to undertake new researches. It was not possible to begin to understand disease until more was known of the chemistry of life processes. A combined attack on the connexion between structure and function in the living cell was being made by chemists and biologists and never before had these two classes of scientists worked so closely and harmoniously together. The reason for this increased cooperation was that improvement in techniques had made it possible to know the molecular architecture of some of the cell's principal "building blocks" in the most intimate detail. A keener appreciation of the niceties of dimensions had done much to give chemistry and biology a common language and a common desire to master it.

Dr. Albert then went on to describe features such as types of bond, the various bond strengths and bond angles and the light which these shed on the problems of how the enzymes of cells managed to capture their substrates and to transform them. The whole question of adsorption and reactions at surfaces came up for review. The physical and chemical features of cell structure which could account for the remarkable specificity of cell chemistry received particular attention.

Dr. Albert asked how modern knowledge of the chemistry of life processes was being applied to the mastery of disease. The answer was that man was living at the beginning of an epoch in which such applications were only just beginning to be made. How fortunate it was to be alive at the very time when a rational approach to the solution of these problems was just beginning to be accepted! Dr. Albert then quoted examples of this new rational approach, drawing on the recent literature of pharmacology and chemotherapy. In the latter subject he referred to work carried out at the Universities of Sydney and Melbourne by himself in conjunction with Professor S. D. Rubbo, Mr. R. J. Goldacre and other workers.

In conclusion, Dr. Albert said that they were beginning to see an answer to the question: what could chemistry contribute to the mastery of disease? Its most valuable contributions would inevitably be along the lines of more and more precise thinking at the molecular level. Above all, chemistry could assume the joyful task of seeing that biologists, who handled the living cell, could have every opportunity to learn, in simple terms, of the living chemistry, that chemistry which, in spite of its seeming complexity, alone could simplify the understanding of life processes and so lead to their maintenance in a state of normal health.

Physical Science in a Post-War World.

In his presidential address to Section *A*, Professor A. D. Ross (Perth) said that the atomic age, ushered in so spectacularly through the design and use of the atomic bomb, offered a greatly widened field for the applications of physics. Progress in civilization had always been linked closely with development of means for obtaining and utilizing power. Physical science, dealing as it did with the whole subjects of matter and energy, merged into both chemistry and physics and laid the foundation upon which engineering was built. The extension of human knowledge and human activities resulting from a major advance in physics must therefore be vast.

While the first application of liberated nuclear energy had been to warfare, that was perhaps its least important role. The fruits of science had too often been directed to base purposes, with an unfortunate reaction on science and scientific research. In this instance, however, it was not too much to hope that the catastrophic possibilities of atomic energy when used in warfare might prove in the end a most powerful factor in promoting peace.

Already the impetus which had been given to research in atomic physics had proved of immense value. There had been an important increase in the number of new radioactive elements which could be used as tracer atoms to study biochemical processes. Moreover, with a greater number of radioactive isotopes of widely varying half-life, it would be possible in medical science to carry out therapeutic treatment under much closer control.

It would be rash to prophesy the extent to which atomic energy would be used commercially and industrially within the next two or three decades. If the same effort was put into research and if investigations received the same financial backing as during the war, it seemed certain that devices for the gradual and controlled liberation of atomic power should be available in the near future.

Continuing, Professor Ross remarked that, whatever might be the speed of development of this new branch of physics, there would be not only opportunities but demand for research workers and industrial officers. The war, he said, had made a serious gap of years in the universities' work of turning out trained men and qualified investigators. During the past few years mankind had been living almost entirely on its scientific capital. The war had diverted scientists from long-range work to specialized problems, but if the nation was to continue to advance in future years, basic research must once more take its rightful place. Basic research provided general knowledge and the understanding of nature and its laws, giving the means of solving many important practical problems, though it might not offer a complete specific answer to any one of them (that being the function of applied research), and though the investigator might have relatively little interest in the practical applications of his work. New processes in industry and commerce were founded on the principles of pure science and were modified as conditions of large-scale operation might indicate.

The universities, Professor Ross pointed out, were uniquely qualified to undertake this necessary programme of basic research. Their functions were to store the knowledge amassed in past years, to impart it as a living and inspiring force to the students of today, and to explore new fields for new truths. It was only in an atmosphere kept free from demands for immediate results and applications that the true spirit of basic research could flourish—an atmosphere free also from the restraining forces of prejudice, custom and vested interests. The universities, too, as permanent institutions, could offer facilities for following out research projects which might take years to complete and which might have to be varied or even drastically altered, as the work proceeded.

To be successful in this sphere it was essential that Australian universities should attract and hold the most able scientists and teachers obtainable. Unless their posts offered adequate opportunity for original work and were sufficiently attractive to compensate for the loss of the greater direct reward which industry and commerce were willing to pay for the best brains, the brilliant men would soon move elsewhere, attracted by a somewhat more reasonable salary, or scared away from the university by the burden of routine work thrown upon them, which should be done by secretarial or junior assistants.

Professor Ross hoped that Federal Government assistance, which was now mainly concerned with lightening the tremendous burden thrown on the universities by the huge increase in student enrolments, would be extended to work towards the master's and doctor's degrees. The increased grant for research made through the Council for Scientific and Industrial Research, he said, was most welcome, but was still quite insufficient to meet requirements.

Discussing the proposal to inaugurate what had been called a research university at Canberra, Professor Ross said that he saw as possibilities (*a*) a university which would take students through systematic courses of instruction and lead them on to research as other universities sought to do; (*b*) a Canberra university which would attract students from other universities as soon as they had graduated, and set them to research work; or (*c*) an advanced research centre for graduates who had proved their ability in research at State universities, which, by offering them special facilities and adequate financial assistance, would retain them as researchers when otherwise they would be seeking posts with less scope for their abilities.

In view of the overcrowding of most of the State universities, no one would question the desirability of instituting another university and so relieving the congestion. But Professor Ross held that to take students from the States as soon as they had completed their honours degrees and to concentrate research in Canberra would be most harmful to the States. Without a live and effective programme of original investigation universities would sink to the level of mere coaching colleges. He would like to be assured that, in drafting proposals for an extensive research programme at Canberra, the Federal authorities would see their way clear not only to maintain but to increase financial assistance for research in the State universities.

The new university at Canberra might well be designed to take up research in certain new directions not at present efficiently explored in the existing State universities, especially in projects demanding new and costly equipment which might be beyond the means of State universities. A central research university would both assist State universities and advance the interests of the Commonwealth as a whole if it could offer attractive research posts to proved investigators who had completed two or three years' research in their State university.

Referring to the financial return from outlay on scientific research, Professor Ross mentioned that an expenditure in England of about £400,000 on industrial research associations had given an estimated return of over 800% *per annum* for a period of several years.

He stressed the wisdom of substantial government grants to universities because of their freedom. Many universities, he pointed out, had become famous because some outstanding man had developed a broad programme of research which in turn had attracted young investigators. He would like to see Australian universities seeking to specialize in physics along definite and distinct lines, and every facility given to a graduate to transfer to whichever institution offered research in a direction which particularly appealed to him.

Professor Ross urged the need for extending the science degree course from three years to four, with an additional year for honours. Six years of university education were required to turn out a general medical practitioner; an engineer's course normally ran to four or five years; and lawyers and teachers commonly founded their training on a preliminary course in arts. Could it be considered possible to train a physicist in three years?

Summing up the possibilities of the new discoveries of science in peacetime use, Professor Ross said that with a vision of vast and cheaper sources of power, of improved aids in medical and biological science, of a more intimate knowledge of the structure and properties of matter, and, above all, of a greater control over animate and inanimate

nature, the future had much to offer man if he was willing to make the most of his opportunities.

The Structure of Keratin Fibres.

E. H. Mercer (Sydney) and A. L. G. Rees (Sydney) discussed the histological structure of keratin fibres and illustrated their remarks by optical and electron micrographs. Conclusions concerning the molecular arrangement within the cortex had been drawn from the electron micrographs and confirmed by X-ray examination of the fibres and derived proteins.

Forecasting the Radio "Weather".

F. W. Wood (Perth) read a paper on the prediction of ionospheric characteristics with particular reference to radio propagation. He said that during the ten years before the war the Radio Research Board of the Council for Scientific and Industrial Research at Sydney had carried out researches into the nature of the upper atmosphere, now known as the "ionosphere", using the pulse-echo technique which was later to prove so valuable in the development of radar. As the war developed and it became necessary to maintain constant air patrols over the coastal waters and shipping routes of Australia, the defence forces had found the need for reliable radio communication. When Japan entered the war the need had become even greater and more urgent because of the paucity of land-line communications to areas north and west of Australia. Radio alone offered a link between headquarters and all forward bases, units, patrols and ships. However, for war purposes this radio communication link had to be reliable throughout twenty-four hours of every day, over all distances and between any two points in the area of operations as well as between the headquarters of the United Nations.

The services therefore had approached the Radio Research Board in 1940 with the proposal that it should prepare information in a suitable form so as to enable reliable round-the-clock radio communication to be carried out and, moreover, that it should make this information available one or two months in advance.

The problem had been tackled and all available data concerning the ionosphere had been collected from the seven observing stations scattered throughout the world. Additional stations were installed until the number rose to 43 before the war ended. The causes of the day-to-day and seasonal variations were discovered and their relationship to sunspots and their activity were determined. With this as a basis accurate predictions had been made three months in advance throughout the years 1940 to 1946, and on only two occasions during the seventy months for which predictions were made had they fallen short of the accuracy required.

Using these predictions the services were able to maintain continuous contact with operational areas and to plan operations with certainty; scores of aircraft had been brought safely back to base by radio navigation when they would otherwise have been lost; ships and aircraft had been able to maintain radio silence whenever necessary with the certain knowledge that they could communicate instantly with their bases in an emergency; and on such important long circuits as those from Australia to London the number of hours of reliable service had been increased from seven hours per day to twenty-three hours per day during the war years.

Important scientific discoveries concerning the nature of the "ionosphere" had also been made during the development of the prediction service, and this added knowledge was now available in peace-time to all radio users in the form of monthly radio propagation bulletins, which were on sale to the public.

The Precise Measurement of Distance by Radar.

Mr. J. Warner (Sydney) said that the simultaneous use of radar to fix the position of an aircraft and the taking of vertical photographs of the ground had made it possible to produce a map of an area to a scale of one inch to one mile without any ground survey having been done. One of the limits in accuracy was the limited knowledge of the velocity of propagation of electro-magnetic waves. Radar could also be used to carry out a large-scale triangulation by precise measurement of base lines up to 500 miles in length. If this was applied to Australia it would be possible to obtain rapidly information from which the shape of the earth could be derived, which was not known with precision in Australia.

The Theory of Flotation.

In his presidential address to Section *B*, Dr. Ian W. Wark (Melbourne) discussed recent Australian research on the theory of flotation. He said that the first commercial flotation process had been developed at Broken Hill less than fifty years previously. From this there had been evolved improved processes by which over fifty million tons of ore had been concentrated in a single year in the United States alone. For a time practice had outstripped theory, both in Australia and abroad, but twenty years earlier metallurgists and chemists, particularly in America, Germany and Australia, had begun a sustained attack on the physical and chemical principles underlying the process.

In Australia this work had been inaugurated by a group of mining companies which had set up a small laboratory for the purpose at the University of Melbourne.

Dr. Wark said that the work continued until 1939, when he, the senior investigator, joined the Council for Scientific and Industrial Research. After a lapse of a year investigations had been recommenced under the auspices of the Council for Scientific and Industrial Research, with Mr. K. L. Sutherland as leader.

Most aspects of the process were now understood. Work was still in progress on other aspects, and Dr. Wark reviewed Australia's contribution in this important field over a period of nearly twenty years.

He dealt first with investigations on the sulphide minerals, from which were obtained the metals lead, zinc and copper. The second part of his address was devoted to the flotation of other types of ore by the use of chemicals better known for their application as wetting agents and detergents.

Lactic Acid Fermentation.

Miss M. E. Maxwell (Melbourne) reported some investigations on lactic acid fermentation. She said that before the war much of Australia's lactic acid was imported, but during the war supplies had been cut off or rendered uncertain by shipping difficulties, and the need to manufacture it locally had become urgent. Research by the Council for Scientific and Industrial Research and the New South Wales Department of Agriculture had determined the conditions under which lactic acid could be made by the fermentation of whey with *Lactobacillus bulgaricus*. Industry had applied these findings to large-scale manufacture. Australia had a ready supply of raw material in the form of whey, much of which had previously been run to waste. A slight modification of the process made it possible by the use of starch hydrolysates to maintain the industry on a continuous instead of a seasonal basis. In spite of competition now from imported lactic acid, there should be a ready and profitable market for locally manufactured acid provided a high quality was maintained. The demand might be stimulated by the increasing use of lactic acid in the plastics industry.

The Determination of Ascorbic Acid.

F. E. Huelin (Sydney) in a paper on the determination of ascorbic acid said that the method now commonly used for estimating the ascorbic acid (vitamin C) content of foods was to titrate an extract with the dye 2.6.dichlorophenolindophenol. This had largely replaced biological assays, in which the ability of a food to prevent nutritional deficiency was measured directly. However, for most fresh fruits and vegetables chemical determinations had been found to give results in good agreement with biological assays. For processed—cooked, canned, dried, or fermented foods—the chemical method might be subject to error. This was due to the effect of the processing treatments on the food and also to the presence of sulphurous acid or ferrous iron in some products. Various methods for overcoming these errors were discussed.

The Microdetermination of Ascorbic Acid in Blood Plasma.

Miss Vivienne Pecover (Canberra) gave the results of an investigation of the sources and magnitude of the errors of the method used by Farmer and Abt (1936) for the micro-determination of ascorbic acid in small amounts of blood. This method had been found suitable for a field survey of children using 0·3 millilitre or less of blood, easily obtained from a child by finger prick.

Some Industrial Fermentations.

Dr. T. R. Sherwood (Sydney) described the arts of making alcoholic beverages, soured milk, leavened bread, vinegar and cheese in very early times as examples of the first fermentation processes used by man. Enumerating the advantages of fermentation for the production of industrial chemicals, as compared with synthetic chemical methods, he said that by means of fermentation it was often possible to produce valuable chemicals from cheap raw materials such as molasses, potatoes, wood waste and even sewage.

Marsupial Phylogeny.

Dr. Joseph Pearson (Hobart) in his presidential address to Section *D* discussed the probable evolution of the mammals from oviparous reptiles. He said that the early mammalian stock had inherited many reptilian characters including oviparity. The egg-laying monotremes had diverged from the main stock at such a stage. After this divergence the main stock ultimately became viviparous. This involved the development of a placenta, which consisted of the intimate apposition or fusion of fœtal and maternal elements for the purpose of carrying out physiological processes (nutrition, respiration, excretion) for the well-being of the embryo.

Dr. Pearson said that there was considerable difference of opinion regarding the type of placenta possessed by the early viviparous mammals. He threw doubts on the view generally held by embryologists. He thought that the common stock from which both marsupials and the higher mammals arose had a primitive type of placenta, somewhat similar to that found in most marsupials, and he considered that the high type of placenta found in the bandicoots did not contravene this view, but was merely an example of convergent evolution. He disagreed with the view that all marsupials originally had a bandicoot-type of placenta and had lost it in course of time. That would indicate degeneration. The marsupials were a curious mixture of primitive and specialized characters, but their method of development and the construction of the urogenital system did not indicate degeneration. They and the higher mammals had diverged from a primitive common stock. In the higher mammals the placenta had become highly efficient, whereas the marsupials had retained a somewhat primitive and inefficient organ which could meet the demands of the growing embryo only for a very brief period of fœtal life.

Dr. Pearson discussed the interrelationships of the marsupials and concluded that the brain and urogenital system offered a much sounder basis of classification than dentition and foot-structure, which were favoured by most zoologists.

In conclusion, Dr. Pearson issued a note of warning regarding the necessity for tackling the problems of marsupial comparative anatomy and embryology without delay, since many important marsupial forms were being exterminated. He thought that the Commonwealth Government should support at least one school of comparative anatomy in Australia to deal with these pressing problems, and he urged the restoration of the Institute of Anatomy in Canberra to its proper status as the nucleus of a school of comparative anatomy.

The Control of Mosquito-Borne Diseases in the Northern Territory.

A. H. Johnston (who had served as officer commanding the 10th Australian Malaria Control Unit attached to the medical services in the Northern Territory) read a paper on the control of mosquito-borne diseases in the Northern Territory. He stated that the aim of the unit was to protect mosquitoes in the Northern Territory against malaria. He pointed out that the malarial history of the Northern Territory had been one of usually localized outbreaks, associated as time went on with the development of definite endemic foci in the native population. With the rapid increase in population density in the Territory, the army medical authority had pressed for active control measures, in order to prevent the creation of a local malaria problem and to keep a malaria-free base for future operations. Owing to the sporadic appearance of malaria in the Northern Territory—in time as well as in geographic distribution—the area was classifiable as potentially malarious. Several severe outbreaks had occurred at intervals from 1879 to 1931 (most infections being malignant tertian), but during the army occupation the incidence remained at a remarkably low figure and all cases recorded were of the benign tertian type.

The factors considered likely to affect the problem of malarial control were: (*a*) the source of infection provided by the aboriginal population (themselves infected by native traders from Timor and elsewhere); (*b*) climatic and geographical considerations, depending upon variations in humidity due to rainfall and the distribution of the main river systems; (*c*) the susceptible population, increased enormously in density along the Sturt Highway; and (*d*) the anopheline population.

No particular anopheline could be incriminated as the definite vector species, so it was not possible to apply "species sanitation". Species were thus considered to vary in their potentiality in different areas.

North of and including the Adelaide River, *Anopheles punctulatus moluccensis* and *bancrofti* were controlled on sight, while south of this centre, *Anopheles annulipes* was specially treated. The latter was extremely adaptable with regard to breeding, while *Anopheles bancrofti* was domestic in its habits, staying in the tents all day after having a meal (and thus permitting tent counts to be made which assisted in assessing the population) and attacking man, although there were other available hosts, such as birds and animals.

The anopheline population varied quantitatively and qualitatively throughout the year, as well as geographically, and the Territory provided a large number of types showing a wide range of morphological and ecological characters.

The bionomics of the Northern Territory anophelines revealed many notable variations, especially of *Anopheles bancrofti* and *Anopheles punctulatus moluccensis*, to those generally recorded in east Australia and New Guinea.

Mr. Johnston outlined the organization of the control carried out by his unit—detection, exclusion and treatment of gametocyte carriers, quarantine of local malarious areas, especially native compounds and known endemic centres such as Roper and Daly Rivers, careful consideration of camp sites and strategic control of anophelines.

In reply to questions, he explained that he aimed at protecting one particular spot in a given area, such as a hospital or aerodrome, not the whole area. It was found that a radius of one and a half miles was effective. Replying to a question as to the extent to which malaria was endemic among the aborigines, he stated that the rate was probably very low, except among coastal aborigines infected from outside—there was no hyperendemic area in the whole Territory.

Acarology.

H. Womersley (Adelaide) in the course of a paper on acarology said that the importance of acarids or mites as the agents of disease in man and animals, and as sources of loss in agriculture, had not been fully realized until recently. He urged that the study of mites should be recognized in scientific circles and that an incentive should be given to students to take up the work. During the war considerable attention had been focused upon mites, mainly from the realization of the important role that certain species of the family played in the transmission of scrub typhus. For the first time in history, specialists in acarology had been attached to the armed forces.

Rickettsial Diseases and their Vectors with Special Reference to Scrub Typhus and Trombidiosis.

A combined meeting of Sections *D*, *I* and *L* took the form of a discussion on "Rickettsial Diseases and their Vectors, with Special Reference to Scrub Typhus and Trombidiosis". The discussion was opened by Dr. F. J. Fenner (Melbourne), who gave an account of rickettsiæ and rickettsial diseases. There had been a great increase in the work done on this subject during the past four or five years, owing to the threat of epidemic typhus in Europe and scrub typhus in New Guinea. The problem had been approached in three ways: firstly, by an attack on the vector; secondly, by raising the resistance of human beings by vaccines; and thirdly, by efforts to find a drug which would either suppress the disease or cure it. The first method had proved to be by far the most successful; the impregnation of clothing with "DDT" in Europe or dibutyl-phthalate in New Guinea had proved very effective. In regard to the second method, vaccines had been prepared in several ways; there had been no adequate clinical trials of scrub typhus or epidemic typhus vaccine during the war, but experience in laboratories had suggested that vaccines gave some protection. It was not, however, comparable to the protection given, for instance, by typhoid vaccine. In conclusion Dr. Fenner said that although several types of rickettsial disease existed in Australia, there was as yet no centre for research on rickettsiæ. It was to be hoped that such a centre would be established at the new Queensland Institute for Research.

R. N. McCulloch (Sydney) spoke about the efficiency as miticides of dimethyl-phthalate, dibutyl-phthalate, "DDT" and benzyl-benzoate, with special reference to their relative values, resistance to washing and duration of effect. The control of scrub typhus achieved by the Australian army could be regarded as successful. Of a total of 2,800 cases notified in New Guinea and the Solomons between the last quarter of 1942 and the end of 1945, only 200 had occurred during the final eighteen months when anti-mite precautions had been undertaken by the troops. Units receiving anti-mite fluid under scrub-itch conditions had usually reported a complete cessation of the itch. Properly used, dibutyl-

phthalate would prevent scrub-itch in Queensland and New Guinea. It was, however, not strong enough to kill American "chiggers", and although large stocks were held in the Pacific, it had not been used in that area because of the failure of tests in Florida and Panama. Mr. McCulloch discussed the possibility of the adaptation of army experience to civilian needs. In some parts of South Australia, duck-shooters and farmers suffered from the so-called "ti-tree itch". In Sydney, especially on clay soil, ticks were a nuisance for some months of the year. Scrub-itch occurred in Queensland. In the army, disinfectants had been applied to clothes by hand or by shaker bottle. Civilian clothes could be treated, though the greasy appearance until after the first wash would be a disadvantage. A disadvantage of dimethyl-phthalate as compared with dibutyl-phthalate was that it had to be reapplied every time clothes were washed. American workers, using benzene hexachloride, had shown that locality disinfection was possible.

. D. A. Gill (Sydney) said that trombiculid mites did not, as far as was known, convey to domestic animals any infectious disease comparable with bush typhus in man. He described a severe dermatitis affecting the lower parts of the legs of sheep in parts of the central highlands of Queensland where seasonal conditions favoured massive infestation with *Trombicula sarcina* (Womersley, 1944). The grey kangaroo (*Macropus major*) was the principal native host, and there appeared to be a clear association between the occurrence of the parasite and the distribution of true black earths in the area concerned. Residents in the locality were attacked, the resulting irritation being known as "black soil itch". The origin and construction of the feeding tube of trombiculid mites were discussed in some detail. Photomicrographs of the tube, as seen in histological section, were shown to illustrate the possibility that, contrary to the general belief, the tube might be contrived by the mite from its own resources.

H. Womersley (Adelaide) said that the "chiggers" or scrub-itch mites responsible for the carrying of scrub typhus from rats to man and for the production of trombidiosis in sheep and cattle were acarids of a large number of species in the six-legged larval stage. These species had formerly been placed in the family Trombidiidæ, but were now separated therefrom as the two families Trombiculidæ and Leeuwenhoekiidæ. In general they were, in the larval stage, ectoparasites of vertebrates.

In 1912 Oudemans had published his monograph on the larvæ of the Trombidiidæ and Erythræidæ, and in the same year Berlese had described the adult form of the Trombidiidæ including the genus *Trombicula* with several species. This genus was characterized in the adult by having a constriction of the body a little anterior of mid-way, the anterior portion being somewhat narrower than the posterior. The adults and nymphs were covered by a thick coating of hairs, whence was derived the popular name of "velvet mites". It was only since 1917 that "chiggers" had been known to be the larvæ of the genus *Trombicula* and its allies. This was first established in Japan, where Japanese workers, notably Kitashima and Myajima, had reared adults and nymphs of *Trombicula akamushi* (Brompt), the vector of tsutsugamushi fever, and had shown that they possessed the characteristic waist of the genus *Trombicula*.

Until 1929 the larval forms of *Trombicula* and allied genera had been placed in the family Trombidiidæ, but in that year Ewing separated them off as a distinct subfamily, and later, in 1944, raised them to family rank. Included here were the genera *Leeuwenhoekia*, *Acomatacarus* and their allies which were known only from the larvæ. In 1945, as a result of the successful rearing by Major G. M. Kohls of two species of the latter genus to the nymph stage, Mr. Womersley had shown that the nymphs and adults did not belong to the Trombiculidæ at all, as they did not have the characteristic waist and differed also in other ways, both in the larval and later stages. They were therefore separated off as a distinct family, the Leeuwenhoekiidæ. So far the larvæ of this family were known to cause only scrub-itch in man.

After describing the appearances and life history of the larvæ of Trombiculidæ, Mr. Womersley said that their importance during the war years as vectors of tsutsugamushi fever or scrub typhus had led to a great deal of taxonomic study, as a result of which no fewer than 150 species of larvæ had been described, drawn from the Indian, Austro-Malayan, Philippine and Japanese regions. All could cause scrub-itch, which was an intensely irritating condition, and while only two species, *Trombicula akamushi* and *Trombicula deliensis*, had been definitely proved to be vectors of the rickettsiæ of scrub typhus, all might possibly be potential carriers.

The larvæ of the Trombiculidæ as hatched from the eggs were very active in their search for a suitable host, although they did not tend to crawl on herbage for more than a few inches. (Species of Acomatacarus, however, would climb onto fence posts or wire.) On man they would make their way through the clothing and find attachment in the warmer parts of the body.

Mr. Womersley then described the finer points of structure by which different species of larvæ were distinguished. He added that, when sufficient material was available for study, there was, within a definite range of population, a definite range of variation of some characteristics. In recent studies, this variation had been treated statistically, whence it was found that certain species, especially the two concerned in scrub typhus, exhibited very definite local geographical forms. It was possible that this might throw some light on the varying geographical incidence of scrub typhus.

The "Frontier" in American and Australian History.

As his presidential address to Section *E* Professor F. Alexander (Perth) outlined the theory of the "frontier" as it was first enunciated in 1893 by the American historian, Professor Frederick Turner. The opening and closing of the frontier was regarded by historians as the key to American history during the past one hundred years. Turner had written of the strength, buoyancy and exuberance of the American pioneers; and of the intellectual self-reliance and organized demand for cultural facilities which had characterized the towns and cities which grew up in the United States as the frontier closed. In Australia there had been no steadily and progressively expanding frontier in the American sense. Australian history had been in the main the story of a people inhabiting relatively narrow coastal belts. There had been examples of the frontier spirit at work—in the pastoral expansion across the Blue Mountains and later in the gold rushes; but the post-humous influence of the frontier on Australian democracy had been small by comparison with the influence it still wielded in the United States. Intellectually, the former frontier regions in Australia had shown few signs of the self-reliance shown by similar regions in America.

The Increase in White-Aboriginal Mixed Bloods.

Dr. A. Grenfell Price (Adelaide) discussed the recent increase of white-aboriginal mixed bloods in the United States, Canada, New Zealand and Australia. He said that recent history indicated a considerable increase in the white-aboriginal mixed bloods of the United States, Canada, New Zealand and Australia. This phenomenon was worth examining from both historical and scientific aspects, for it was creating and would continue to create important racial, social and economic problems. Interbreeding between the whites and the American Indians, Maoris and Australian aborigines had, of course, gone on for a very long time. For example, the population of French Canada had long contained, through the fur trade, a considerable amount of Indian blood in its veins. There had been, however, little authentic information on the subject until comparatively recent censuses when several countries had attempted to estimate with some exactitude their percentages of full and mixed blood aborigines. These efforts had suffered from the usual difficulties of census-taking, particularly that of determining the percentage, if any, of white blood in individual aborigines. As, however, the critics usually contested the statistics on the ground that the percentages of white blood were higher than those indicated, their contentions, if valid, tended only to strengthen the conclusion that mixed blood increase was proceeding at a considerable rate.

The answer to three important questions could be sought in recent statistics: First, were the total aboriginal and mixed blood populations of the United States, Canada, Australia and New Zealand increasing? Secondly, were the pure bloods increasing? Thirdly, were the mixed bloods increasing?

Available figures could be regarded as fair indications that the total populations of United States Indians, Canadian Indians and Maoris were increasing, but that the total Australian aboriginal population was declining. The statistics also demonstrated that all the full blood native populations were barely holding their own or were declining, but that the mixed blood populations, with the exception perhaps of the Australian, were showing a rapid and vigorous growth. So rapid indeed was the advance that the United States Department of Indian Affairs claimed that the total Indian

population was increasing at a rate of 1·2% *per annum* as against 0·7% for the general American population, while from 1926 to 1936 the Maoris advanced by 29·3% as against 10·93% in the case of the Europeans. In certain regions even the Australian aborigines, or more probably the mixed blood groups, were advancing considerably in numbers. At the Canberra Conference of 1937 Dr. Cook, the Chief Protector for the Northern Territory, had said that unless the black population was speedily absorbed in the white, the white population would be absorbed in the black in about fifty years. At the same conference Mr. Neville, the Native Commissioner for Western Australia, had said that between 1905 and 1937 the natives of the south-west had increased from 1,419 to 6,000, and that in 25 years they would number 15,000.

Several factors accounted for the recent increase of aborigines in these four countries. First, these people were enjoying protection from, and possibly in some cases an increased resistance to, smallpox, which, in the early stages of the white invasions, had been by far the most potent destroyer brought in by the invaders. It was true that the aboriginal people still suffered a heavy mortality from social diseases, tuberculosis and other ailments, but no single disease had produced the decimating effects wrought by smallpox. Furthermore, most white governments had recently made some scientific efforts to preserve native health, and these efforts had met with a certain amount of success.

A second cause of improvement had been that the white invaders had abandoned the former practice of seizing native lands and of slaughtering the aboriginal peoples if they had resisted or killed the stock of the incomers. The majority of governments had reserved native lands; and the more advanced peoples such as the Americans and Canadians had honestly devoted the resources of these reservations to their native wards.

A third cause of progress had been the genuine efforts of certain governments to acculturize their aborigines on scientific lines. Early governmental and missionary policies had attempted to turn stone age peoples into civilized Christians in one or two generations and ruinous detribalization and demoralization had inevitably resulted. Improvements such as the Roosevelt-Collier New Day for American Indians, or for the emergence of the Young Maoris Party had seen a more gradual acculturation process, a return to many of the old tribal ways of life and a revival of native or mixed blood leadership. Statistics seemed to indicate a possible connexion between government expenditure and population increase, although the advance or decline of native population naturally depended upon many factors other than government liberality creating improved policies. Nevertheless it might be significant that the only country in which the total native population and the mixed bloods were not increasing was Australia, which had been outstandingly mean, neglectful and backward in regard to its native wards. Whereas the United States was spending on the eve of the war £23 *per annum* on each Indian and Canada £10, the Australian Commonwealth and States were spending only 63s. per aboriginal (State 74s. and Commonwealth 32s. on its wards in the Northern Territory). In comparison with this Australian expenditure, New Zealand in 1939-1940 had spent on the education of about one-half of its Maori children nearly as much as the Australian governments had spent on their 77,000 aborigines.

A fourth probable cause of the recent increase in certain aboriginal populations was hybrid vigour. This aspect of recent history had received little investigation and required research such as that conducted by scientists in Hawaii. Evidence from these islands indicated that the part Hawaiians were increasing more rapidly than the pure Hawaiians were dying off, that there had been an increase of 125% in the part Hawaiian population in the last twenty years, and that the part Hawaiian was much more resistant to disease than his pure bred brother. Scientific investigation might well indicate the same phenomena in regard to the mixed bloods of the United States, Canada, New Zealand and possibly even of parts of Australia.

The problems arising from the recent increase of total native populations and more particularly from mixed blood increase were serious for both the native and white populations. Apart from the religious and philanthropic obligations involved, it was a serious matter for white communities to have in their midst islands of people who were very frequently below the whites in standards of health and education, and, if detribalization had been effected, below them too in standards of culture and behaviour.

In the Roosevelt-Collier policy inaugurated in 1934 the United States had begun to make really adequate efforts to solve these difficulties, and Canada, New Zealand and some of the Australian States had made progress in policy, in administration and in financial generosity.

There was little doubt that, excepting perhaps in a few areas such as the south-west of the United States, the white majority peoples would absorb the native minorities. In most countries, however, complete absorption lay far ahead; in the interests of both whites and aborigines scientific policies were essential to ease the intermingling and acculturation.

The Zoological Position of Man and the Data of Physical Anthropology.

Professor A. N. Burkitt (Sydney) in his presidential address to Section F" discussed the zoological position of man. He said that man might be defined as forming a single polytypic species composed of various races all capable of interbreeding. His evolution had been reticulate, and he had become the biologically dominant animal of recent times. At any one time level there had probably been only one species of man with different races or subspecies which could interbreed. There had probably been three species successive in time: *Homo erectus* (Java and Peking man), *Homo intermedius* (Neanderthal and other races) and *Homo sapiens* or modern man (Weidenreich, Dobzhansky *et cetera*). With the progressive enlargement of the brain which had taken place, there occurred a progressive broadening and rounding or brachycephalization of the brain case, reduction of the teeth, jaws and palate, and fœtalization of the skull and particularly a slowing down of the time of closure of the brain case sutures. Professor Burkitt suggested that rate-genes had been the effective agent in this evolution and enlargement of the brain. Correlated with the enlargement of man's brain was his most unique feature—the development of speech and the acquisition of conceptual thought, the use of tools and the development of a cumulative tradition, the last-mentioned feature being accelerated by the discovery of writing. Further, man was the only animal which had become biologically dominant within the range of a single species. He had also become the most widely dispersed animal known, and the most variable species of animal in existence, especially with regard to brain and mind. Man's evolutionary history was unique; in the words of Julian Huxley, "a brain capable of conceptual thought could not have developed elsewhere than in a human body"; man alone had all the necessary prerequisites.

Referring to the study of modern man, Professor Burkitt said that recent studies in genetics showed that the task was to map out the genes or hereditary factors which determined man's adult form and to clarify the action of various environments upon them. Up till recently physical anthropology had been concerned with the past history of mankind, and with the amassing of various measurements of living man. These had often been of doubtful significance, and required to be further amplified and replaced by an analysis and mapping out of man's genes. The progress made could be judged by the fact that probably only about 100 of these were known, while the existence of some hundreds more was suspected and the total number might well prove to approach 50,000 or more. In Australia little was known of man's growth, of his fertility and the factors affecting it, and of his variability. A school of physical anthropology was a fundamental need, and such studies should not be the spare-time interests of scientists in other fields.

Professor Burkitt went on to say that man had other distinguishing features. For instance, he was continuously sexed, in contrast to most other animals. Also he had made great use of his "post-maturity"; Huxley, in about 1940, had pointed out that "all the members of the British War Cabinet are in their post maturity". Man also was unique in the degree of freedom of his mind, in both analysis and synthesis, so that he was not dominated by his instincts. However, he was as a consequence almost the only animal normally subject to psychological conflict, which accounted for the development of the phenomena of conflict, repression and suppression. Other unique by-products of the human mind were pure mathematics, religion, philosophy, the appreciation and creation of music, pictures and sculpture *et cetera*. Even the attributes which he shared with other animals—eating, drinking, sleeping and mating—had been elaborately decked out with all kinds of peculiarities.

Brachycephaly.

Professor A. A. Abbie (Adelaide) read a paper in which he discussed the increasing brachycephalization of man in general from the aspects of evolution, race, stature,

mechanical factors, heredity and environment, sex and age. All except the mechanical factor were shown to play a part in determining the form of the head, but the part played was limited, and of significance only in so far as it formed part of a general evolutionary trend. In man this trend was towards a progressive increase in stature, and a progressive tendency to maintain the infantile head form at a cephalic index of about 81·5. This tendency was not of only limited anthropological interest, but had the widest biological application, finding parallels in other animal groups. These findings emphasized the fact that anthropology was merely one aspect of biology at large.

Speech Sciences Unit.

Professor J. McKellar Stewart (Adelaide) welcomed the members of the speech sciences unit (Section *F*) in his capacity as Vice-Chancellor of the University and also as a member of the committee on speech sciences. In introducing this subject into a general scientific programme, new ground was being broken, and it was particularly fitting that the first meeting should take place in Adelaide where for many years work in speech studies had been going on.

Professor J. A. Fitzherbert (Adelaide) in his presidential address traced the development of scientific speech research from classical times to the present day.

T. G. H. Strehlow described "The Rhythmic Structure of Aranda Charts", using gramophone recordings and lantern slides.

Miss Olive Abotomey (Adelaide) read a paper entitled "Some Aspects of Spoken English in Australia" and showed two films entitled "Breathing" and "The Human Voice" respectively, lent by the Education Department of South Australia.

Professor A. A. Abbie (Adelaide) reviewed the history of the knowledge of cerebral control of speech. After referring to the humoral theory held by Aristotle, he described briefly the work of Gall, Bouillaud, Broca, Charcot and Trousseau. The great English neurologist, Hughlings Jackson, had made most important advances in this subject in the years 1864-1884. He had distinguished dysarthria from aphasia and had been the first to appreciate that the problem should be approached as much from the psychical as the anatomo-physiological aspect. The latest and most notable contribution had come from Head's examination of casualties of the 1914-1918 war.

A paper on the causation of stammering and its treatment written by Dr. D. W. H. Arnott (Sydney) and Miss Elinor Wray (Sydney) was read. The writers explained that stammering developed from the simple non-fluency of normal childish speaking to the complex speech situation that constituted the "stammering personality". Treatment should be based on the conception that a new idea of fluent normal social speech had to be created in the mind of the stammering child. A method of treatment by which this could be achieved was described.

Miss Margaret Badcock (Melbourne) traced the development of speech therapy as a medical auxiliary service in Britain. The same speaker in a separate paper described the speech therapist's contribution to the treatment of two patients suffering from gunshot wounds of the larynx.

In a discussion on physical defects affecting the speech mechanism and their treatment, Dr. G. M. Turnbull (Adelaide) described the surgical treatment of war injuries of the jaw, lips and tongue. He showed a man who had suffered considerable destruction of his mandible as the result of a gunshot wound, necessitating an epithelial inlay. In order to allow the essential mobility of the lower lip on the underlying structures by restoring the labio-gingival groove, and so permitting the patient to wear a denture, he had been obliged to make a graft. The result was satisfactory with regard to phonation even when the denture was removed.

Dr. D. G. Mackay (Adelaide) showed a girl of nine years who had had an extreme degree of unilateral (left-sided) hare-lip and cleft palate. He had operated on the lip when she was four months old and the palate at about a year old. She had been under constant training ever since by the speech therapist at the Adelaide Children's Hospital. She gave a recitation to the section to show the progress made in articulation, especially as regards certain difficult words, for example, "orchestra". She also showed great self-possession in contrast to the usual diffidence evinced by children with this type of deformity.

Dr. T. D. Campbell discussed the effect on speech of malformation of the teeth, and pointed out a possible field of research in the effect on Australian speech of artificial dentures and particularly of badly fitting ones.

Dr. Hubert Jay (Adelaide) discussed a paper received from Mr. V. E. Negus (England) on the function of the cricopharyngeus muscle and its bearing on the reeducation of patients after laryngectomy.

Miss Olive Abotomey (Adelaide) read a paper on speech disorders in Australian school children. Her experience in Australia had been confined to the speech problems of South Australian school children during the past seven years. The fact that these observations had been made during war-time was not without significance. She had found that speech disorders among school children were quite common; they were to be regarded as serious, affecting as they did the whole cultural development of the child. By far the most pressing of these was stammering. Miss Abotomey described her experience in the treatment of stammering children in school clinics. She also referred to cleft palate speech, aphonia and lalling.

Miss E. P. Colclough (Melbourne) gave an outline of recent developments in speech training in Victorian schools.

F. P. O'Grady (Adelaide) said that sound had been for many years somewhat of a Cinderella among the other branches of physics. Very little practical application had been made of the scientific study of sound until the advent of the telephone and later of the radio focused attention on the need for studying sound thoroughly. The word sound was used with two meanings—one covering the physical existence of vibrations in air or other media, and the other meaning the sensation caused in the brain when these vibrations were activating the human ear. It was impossible to separate completely the study of these two different aspects of sound, and it was necessary to have an appreciation at least of the physiological aspects of sound in order to understand properly some of the problems in physics and engineering which arose in the physical side of the science of sound. The use of electrical transmitting systems, such as the telephone and broadcasting, had focused attention on the problem of just how much of the original sound waves might be omitted while still producing reasonably satisfactory performance at the receiving end. One of the important facts revealed by investigations was the amazing complexity of human speech and the correspondingly astonishing performance of the human ear considered as a mechanical device.

During the congress, a demonstration of a magnetic wire speech recorder, oscillograph and other apparatus was on view in the physics department of the university. It was estimated that over a thousand members visited this demonstration and heard recordings of their own speech.

Productivity.

Dr. Roland Wilson (Canberra) in his presidential address to Section *G* said that most current indexes of productivity were obtained by dividing an index of the "quantity" of production by the numbers of persons engaged in production. "Quantity" in the economic sense, however, was very different from quantity in the physical sense, since the physical quantities of the articles produced had to be given some values, however conventional, before they could be added together. This involved many theoretical difficulties, because relative values were in practice rarely the same at different dates, and there was no absolute standard of value. A single, exact measurement of the change between two dates in the "size" of the output of an industry or of all industries could be made only when the relative values of the different individual products had not changed. In practice, therefore, most productivity indexes were merely approximate descriptions of a series of quantitative changes which could be described with complete accuracy only by giving a full account of the changes in the quantities and relative prices of the individual articles making up the total output. Such "summaries" of a series of complex happenings had their uses, provided it was realized that any summary became less useful in proportion as the facts to be summarized became more complex.

Dr. Wilson said that another method sometimes used was to measure the size of the output in terms of some single or "composite" article different in kind from the products of the industry under examination. The physical quantities of the articles actually produced were ignored, the procedure being to divide the total values of the output by an index of the prices of the single or "composite" article chosen as the standard of measurement. This was the only method available when data on the quantities and prices of the actual products were not available. In effect the method assumed that the value, or utility to the consumer, of the

article or combination of articles chosen remained unchanged from year to year.

Dr. Wilson gave reasons for thinking that most indexes of productivity compiled over extensive periods tended progressively to understate the real improvement in material well-being which was made possible by industrial and scientific advance. This was due partly to omissions from the indexes and partly to the technicalities of their construction.

Dr. Wilson stated that there were at present about one and a third dependants for every active worker in Australia. Unless migration affected the position substantially, the proportion would shortly rise to about one and a quarter, and fluctuate a little above that level for the next fifty years. This forecast could easily be upset, however, by changes in the school leaving age, in the usual age of retirement from work, by heavy immigration, or by changes in the willingness of females to seek work outside the home. If all persons of working age were regarded as potential workers, and children and old people as dependants, there was at present on this basis about 0·5 dependant per worker, compared with about 0·7 in 1881. The figure would probably rise a little in the next few years, reach nearly 0·6 by 1981, and stay at about that level for the next twenty years.

It was also suggested that the average level of productivity in so-called "tertiary" industry was not greatly different from, though a little below, the average level in primary industry, which in turn was somewhat below the average level in secondary industry. There was some long-term tendency for a larger proportion of the working population to enter tertiary industry, but it was by no means certain that this tendency would in future be very pronounced or even that it would continue indefinitely.

Some Recent Changes in the Outlook for the Child.

Dr. F. V. G. Scholes in his presidential address to Section *I* said that social legislation in the latter part of the last century had paved the way for concerted attempts to legislate, plan and provide particularly for the welfare of the child. As knowledge increased, impetus had been given in many directions to the establishment of special movements, from antenatal care and food and milk legislation to school architecture and improved artificial foods.

Infant mortality had fallen greatly; it was proper to inquire whether this had resulted in an equivalent saving of useful and happy lives, and what was the position of the added number of survivors. Mortality from natal and neonatal causes had scarcely become less during the past thirty to forty years, and accounted for more than half of the total infant mortality. Improvement in the other half had not affected the pneumonias, and was accounted for almost entirely by the disappearance of enteric infection as a major cause of death.

Infective enteritis attacked and killed many healthy children, but in many cases it was a sequel of a state or states already in existence. Most obvious of these was malnutrition, and vicious circles were created by the introduction of diseases, such as whooping cough. Certain causes of malnutrition had diminished greatly, for instance, congenital syphilis. Many causes remained, particularly faulty feeding. Much had been done to improve matters. The greatest single cause of the fall in mortality rates was safer milk. The present conditions of procurement, transport, delivery and storage in homes were not yet satisfactory. Until they were satisfactory, the increasing practice of boiling or simmering milk for infants was to be commended.

After infancy acute enteritis disappeared as a cause of mortality, and from then on difficulties in food supplies were matters of education and economics. Among the difficulties were the high costs of essential foods, bad keeping qualities, poor delivery and storage facilities, and seasonal variations in supply. After infancy the principal apparent cause of death, illness and subsequent invalidity was infection of the respiratory tract. This was caused by lack or insufficiency of proper response to infective stimuli. The factors involved were hereditary, due to faulty nutrition of body cells or else unfavourable dosage and spacing of infective stimuli. The last was probably the greatest factor. In tuberculosis of infancy favourable conditions produced good or partial immunity; if conditions were unfavourable, children might die quickly from meningitis or generalized tuberculosis. There were all intermediate grades from quiescence to gradual spread. Children should be protected from gross infection from open tuberculosis in other members of the family. During the stages of immunization children were in danger if they developed measles, whooping cough or bronchopneumonia.

Only children were likely to escape measles and whooping cough until they went to school, but where there were older children measures to postpone the attack should be taken if possible. Important complications could be aborted, or well treated by sulphonamides or penicillin, or both, but even so, whooping cough, if at all severe, remained the most dangerous illness for a very young child. Either full protection or attenuation could be attained in measles by the use of convalescent or pooled adult serum. Gamma globulin was more effective and the dose could be standardized. A very satisfactory trial of this had been made in Melbourne in 1945. Vaccine prophylaxis of whooping cough was more reliable than with earlier preparations, and was recommended for all young children. Dr. Scholes said that he would try it in the face of danger even for children three months of age. Combined immunization against whooping cough and diphtheria had the advantage of convenience, especially in large-scale campaigns, but was not necessarily the ideal method for individual children. Each case must be taken on its merits by the conscientious practitioner. Sweeping claims of efficiency were not entirely justified, and definite promises should not be made in respect of individual children.

The mortality from diphtheria was still considerable, but if fatalities were excluded, diphtheria was not an important illness like whooping cough. Survivors rarely presented any after-effects. Too definite a correlation had been assumed between severity of illness and bacterial type. This applied both to epidemics and to individual illness. In the case of children immunized in infancy, confirmation was definitely necessary about the time of entry into school.

After infancy streptococcal infection did more damage than any other. Repeated gross infections produced gross damage of respiratory tract, both as frank streptococcal infections and when complicating diphtheria, measles, whooping cough *et cetera*. Treatment of local effects had been revolutionized by chemotherapy, and lesions could often be aborted. Remote effects were nephritis and rheumatism. Streptococcal pharyngitis rather than scarlet fever should be the qualification for skilled home or hospital treatment. Hospital stay need not be long, provided early treatment was satisfactory and a thoroughly efficient follow-up was maintained. The outlook in nephritis was good on the whole and relapse was not common unless tonsils were unhealthy. Tonsillectomy should be considered at the first favourable opportunity. In rheumatism there was the same precipitating factor as nephritis, but more predisposing factors. In rheumatism as opposed to nephritis the soil was more important than the seed. The rheumatic child should be recognized early, before gross damage was done. Of several methods of prophylaxis at present employed on a large scale, continuous sulphonamide medication appeared the best, although this was hardly an ideal method.

Professor A. A. Abbie (Adelaide) thanked the speaker for his address and said that the subject was one which Dr. Scholes had made his own and to which he had made important contributions.

Dr. A. R. Southwood (Adelaide) said that the members of the section were honoured to have Dr. Scholes as their president. He personally owed a debt of gratitude to Dr. Scholes for help and advice on many occasions. In spite of notable advances in the study of child health much yet remained to be done. Dr. Southwood then referred to the work done in the field of infant welfare by the late Dr. Vera Scantlebury Brown, of Melbourne. In Adelaide progress had been steady, but not dramatic. Dr. Southwood referred to the pioneer work of Dr. F. S. Hone, to the work of the Mothers and Babies' Health Association under the guidance of Dr. Helen Mayo, to recent investigations by Dr. Jungfer at Lobethal, and to the Lady Gowrie Health Centre. The milk supply was a good hardy annual problem; perhaps the grocer would replace the milkman and dried milk would be the milk of the future. This would solve once and for all the question of bacterial contamination. With regard to tuberculosis, there was in Adelaide a small preventorium for children who had been exposed to infection with tuberculosis. Dr. Southwood had been interested to hear of Dr. Scholes's experiences with γ globulin and also his views on rheumatic fever. He hoped for the establishment of a national organization to deal with rheumatic heart disease.

Dr. F. S. Hone (Adelaide) said that he too owed a debt of gratitude to Dr. Scholes for the address he had just given and for his help in past years. Members of the section were fortunate in having a speaker with first-hand experience to recount the different manifestations of the problem of health in childhood. Dr. Scholes's book, published some years earlier, had been a revelation to Dr. Hone. He

had been impressed by the way in which disease in the fight was being driven back and back. As Dr. Scholes had said, the fall in infant mortality was mainly due to the decrease in the incidence of entero-colitis; the point of interest had gradually extended to neonatal diseases and their effects, and to prenatal conditions. The effect of the rubella epidemic in 1943 had come as a revelation. The part played by the Rh factor in the production of spastic disease was still unknown. Not the least valuable part of the paper under discussion was to remind practitioners that the main emphasis was to be placed on the early life of the young child. Remote effects of influences occurring during this period were still unassessed. The community as a whole had still to learn the lesson of medical care of the very young, and the part it could play in the prevention of disease in later life.

Dr. G. Cuthbert (Sydney) thanked Dr. Scholes especially for his remarks on the subject of whooping cough. In New South Wales there was not yet sufficient emphasis on prophylactic inoculation. She was grateful for Dr. Scholes's clear statement of his opinion.

Dr. E. L. Sandford-Morgan (Adelaide) said that she agreed fully with Dr. Scholes's views about the importance of the prevention of whooping cough; she was interested to hear his opinion of prophylactic inoculation and especially of the possibility of its efficiency at a very early age.

Dr. J. L. Hayward (Adelaide) was interested in Dr. Scholes's evidence of γ globulin, and asked when it would be available for general use and how the cost compared with that of pooled human serum.

Dr. John Dale (Melbourne) said that when he came to Melbourne twenty years before, Dr. Scholes's name was already a household word. He agreed that measles and whooping cough caused more deaths than diphtheria, but wondered whether the position in regard to the former two diseases had not improved in recent years. If so, the improvement might be due to a change in the infecting organism or to an improvement in the general nurture of the population. The social distribution of whooping cough and measles suggested that the latter cause might operate, as the death rates were higher among the less fortunate social classes. Dr. Scholes might confirm or deny this. If it was true, it indicated an obvious avenue of progress to the improvement of the resistance of the population as a whole. That, after all, was what they had to depend on. It was impossible to live in a sterile environment. They could live on dried milk, but they still had to breathe the dusty air and shake hands with one another. In the last resort the soil was the most important factor that could or should be controlled.

Miss Nancy Atkinson (Adelaide) asked Dr. Scholes's opinion on the relative values of alum-precipitated toxoid and formalinized toxoid and also what particular vaccine he would recommend for the prophylaxis of whooping cough.

In reply to Dr. Hayward, Dr. Scholes said that the γ globulin used in Melbourne had come from two different sources and he was unaware of its cost.

In reply to Miss Atkinson, Dr. Scholes said that the choice of diphtheria prophylactic used was not a matter of outstanding importance. In practice it was found that, provided a child received either "A.P.T." or formalinized toxoid administered in proper fashion, provided a subsequent Schick test gave a negative result and the child's resistance continued to be stimulated by the ordinary encounters of community life, he would remain immune for the rest of his life.

Dr. Scholes had known diphtheria to occur in children and adults who had received inoculations of either "A.P.T." or formalinized toxoid; in such persons malignant diphtheria and even death from diphtheria had been known to occur. But in none of these cases had any attempt been made to verify the fact of immunization by a Schick test performed after inoculation. In private practice, the making of a post-inoculation Schick test was desirable. Even if the Schick test gave a negative result and the child subsequently was isolated in some remote country district, he might lose his immunity because of the absence of stimuli. The years had shown that some children were hard to immunize.

With regard to whooping cough vaccine, Dr. Scholes said that he had been hit to leg, in both medical and lay Press, some twenty years before for criticizing enthusiastic and, in his opinion, premature, reports about diphtheria immunization. The position in regard to immunization against whooping cough at present was similar to that of immunization against diphtheria twenty years earlier. When whooping cough vaccine was first introduced, doses of 10, 20 and 100 million organisms were given and extraordinarily good results were recorded on all sides. Later, much larger doses were given, but he and his colleagues in Melbourne had not been very happy about it, until it was found that a particular phase of the organism was most suitable; and all sorts of refinements and improvements were made in the preparation of the vaccine. Present reports in the literature were more honest, extensive and better controlled than earlier ones. As an instance, he would say that of a hundred unimmunized children encountering the infection, thirty would not get whooping cough, thirty would have it in a mild form, thirty would have moderately severe whooping cough; the remaining ten would have severe whooping cough and half of those would die. Of one hundred children immunized with the modern product, fifty would have no whooping cough, thirty would have mild whooping cough, ten moderately severe whooping cough; the remainder would have severe whooping cough and one or two would die. In short, Dr. Scholes would say: "Advise it, publicize it, but don't promise the public too much."

Dr. Alan Finger (Adelaide) said that he appreciated Dr. Scholes's critical and reserved approach to the question of prophylactic inoculation, but deprecated an over-cautious and conservative attitude on the part of public authorities. In a recent article in the *British Medical Journal*, describing some work done at Oxford, serious doubt had been cast on the value of whooping cough vaccine as a prophylactic measure. Incidentally, in the Oxford experiment the vaccine had been given intramuscularly and not subcutaneously. The American experiments with whooping cough vaccine were more extensive and vaccines of a more modern type had been used. The conservative attitude of Britain in regard to the use of whooping cough vaccine was similar to the attitude, some years before, to immunization against diphtheria. It was perhaps because of this that during the recent war more children had died of diphtheria than as the result of enemy action. Dr. Finger thought that doctors should go boldly ahead with the use of whooping cough vaccine for prophylaxis, if possible with adequate controls.

Professor A. Abbie (Adelaide), referring to the neonatal death rate, said that medicine seemed to have arrived at a minimal rate, and had perhaps reached the limit of ability to influence protoplasm itself. Perhaps its inherent capacity for going wrong was something with which they were unable to cope. Morbidity and mortality differed in different communities. A community which denied its members the advantages of modern science was as guilty of murder as an invading army in time of war. It was the duty of this section of congress to formulate new ideas, though there were sometimes difficult in the interpretation of these. He recalled the work of Lord Lister, who introduced a method which had been interpreted in various ways. Too many people were content to go through the motions of a new method without checking their results. In the instances under discussion, as Dr. Scholes had pointed out, it was immunization, not merely inoculation, that must be performed. Professor Abbie moved that a vote of thanks be accorded to Dr. Scholes. This was carried with acclamation.

Dental Health Service for Children.

In a paper entitled "Public Health Service (Oral) for Australian Children", Dr. R. M. S. Taylor (Auckland) advocated the employment of dental nurses trained as specialists in children's work. The New Zealand scheme, established twenty-five years previously, had shown that dental nurses were able to perform this work. The saving of deciduous teeth and early treatment of permanent teeth had been of great benefit to the health of children. Dr. Taylor showed a film depicting the training of dental nurses and the work done by them for children in New Zealand.

A paper on "Tooth Decay and Dento-Facial Deformity in Children" by Dr. P. R. Begg (Adelaide) was read by Mr. Barrett (Adelaide). Dr. Begg stated that over 90% of children had decayed teeth; this was caused, in his opinion, by the removal from food of coarse, fibrous, gritty substances which were always present in the food of the Stone Age men, and which prevented carbohydrate lodgement on teeth. A tenfold increase in the existing dental personnel would be required for adequate dental education of the public, and this was impossible without government dental services. Less than 20% of children received dental treatment; the prevention and treatment of tooth decay required this large increase in personnel. Dento-facial abnormalities which occurred in a large percentage of the population were hereditary. Casts and pictures were shown, illustrating different forms of malocclusion before and after orthodontic treatment.

Dr. John Dale (Melbourne) said that he agreed wholeheartedly with Dr. Taylor in regard to the tackling of preventive dentistry by the training of special personnel. The New Zealand scheme had been creating great interest in Australia for some time. Some members of the Dental Board of Victoria had advocated the training of dental nurses, but the scheme had met with opposition. There could be no doubt as to the influence on health of this disease of civilization, and the situation was no better than it had been thirty years before. Dr. Dale also congratulated Dr. Begg on his very interesting paper. He thought that a great deal of malocclusion was caused by lack of exercise of the jaws in youth, because over-soft food was given to young children.

W. D. Brown (Adelaide) said that Weston Price, an American authority, had studied primitive peoples in all parts of the world, and was emphatic in his belief that the nutritional element was by far the most important factor in the production of dento-facial abnormality. Maternal nutrition played a very large part. Weston Price had noted that when primitive peoples came to live under civilized conditions, the shape of the jaws altered and malocclusion occurred. This did not contradict the statement that heredity played a part. It was probably a mistake to draw a distinct line between the influence of heredity and nutrition.

T. B. Lindsay (Adelaide) said that after the last war of 1914-1918, the Orthodontic Section of the British Medical Association had sent a body of men to Austria. They had observed that the children of wealthy families who had had plenty of food, much of which consisted of cakes and pastry, showed extensive dental caries, while in poorer children who were dying of starvation, no decayed teeth were found. This, he thought, showed that conditions in the mouth were of more importance than general nutrition. It was difficult to see how diet could affect a tooth once it was erupted, though it might affect it during development.

Dr. F. V. Scholes (Melbourne) thought that a dental auxiliary service might be extremely useful in Australia. Divergent views on the cause of dental caries were not necessarily mutually exclusive; it was probable that a great many factors were concerned.

Ten Years of Diphtheria Prophylaxis in the Metropolitan Area of South Australia.

Dr. Alan Finger (Adelaide) read a paper describing ten years of diphtheria prophylaxis in the metropolitan area of South Australia. He said that organized diphtheria prophylaxis had been practised in the area only since 1936. Diphtheria incidence and mortality had declined over the previous three years, but it was too early as yet to attribute these declines to the prophylaxis, since there had been periods of similar low incidence and mortality in the preimmunization era.

Immunization was carried out by local boards of health, by private doctors and institutions, formol toxoid being used in almost all cases. Children receiving three injections were assumed to be immunized in the absence of follow-up Schick testing. Data supplied by the Central Board of Health, supplemented by very approximate data from other sources, showed that some 38,000 children up to fourteen years of age were now "immunized", approximately 48% of the total. About 44% of the all-important pre-school group had been "immunized". The proportions of protected children were not yet great enough to ensure against recurrence of diphtheria epidemics.

The average incidence of diphtheria among the unimmunized children had been 7·71 per 1,000, seventeen times the rate, 0·45 per 1,000, among the "immunized". The data on diphtheria among the "immunized" were incomplete, however.

Diphtheria occurring in 77 "immunized" children treated at Northfield Infectious Diseases Hospital had been generally very mild. There had been two deaths in this group, but there was no proof from Schick testing that the children had been effectively immunized.

The predominant infecting strain of *Corynebacterium diphtheriæ* in Adelaide had changed over the past two years from *mitis* to *gravis*. The non-occurrence of diphtheria epidemics in these circumstances might indicate some effect of immunization. There was no evidence that mass immunization had increased the diphtheria carrier rate.

Public response to the campaigns had been very promising, especially in view of the relatively small amount of publicity given them. As up to 97% of children presenting for the first injection had completed the course of injections, it was probable that response to follow-up Schick testing would be good.

Proposals for compulsory immunization should be considered very carefully in the light of the splendid results of voluntary campaigns in New York, Toronto and elsewhere, where diphtheria had been virtually eliminated. It was desirable that a Schick testing survey should be made to determine the efficacy of the prophylactic treatment. It was also desirable that a planned experiment, with adequate controls, should be made of combined diphtheria and whooping cough prophylaxis.

More vigorous and extensive campaigning and more convenient organization of immunizing clinics by central and local health authorities in cooperation with other bodies could eliminate diphtheria within the next ten years.

Dr. J. E. Caughey (Auckland) described recent alarm at the increasing incidence of diphtheria in Auckland. A campaign, sponsored by the New Zealand Branch of the British Medical Association, had been organized, and 10,000 children were immunized at thirty different schools on Saturdays with alum-precipitated toxoid. The subsequent Schick tests had not yet been made.

Dr. Finger was asked what type of strain was being used by the Commonwealth Serum Laboratories for making toxoid. Dr. Finger replied that he understood that it was Park 8 strain.

Dr. J. M. Dwyer (Adelaide) referred to a paper he had published in THE MEDICAL JOURNAL OF AUSTRALIA in January, 1938, regarding immunization in the Hindmarsh district of Adelaide. In the accompanying graphs Maloney reactions were shown to be definitely lower than in English reports. He discussed severe Maloney reactions. Associated with the severe reactions there was generalized adenitis, a temperature of over 104° F. and desquamation; the picture resembled that of a severe Mantoux reaction. Generalized adenitis was a new reaction, and when Dr. Dwyer met co-workers in England in 1940, O'Brien, Almira and others, this point had been referred to. With regard to Schick conversion rate, he had performed 625 tests twelve months or two years after immunization. He did not remember whether preliminary Schick tests had been performed in every instance. He had arrived at the conclusion that after immunization the conversion rate was 99·2%. He had also tested a number who had had alum-precipitated toxoid, and in their case the Schick conversion rate was only about 80%. He had found that in using "A.P.T." one had to be constantly on the alert to shake the bottle. He had reached the conclusion that no control of susceptible people was achieved until 50% of the child population had been immunized, and that positive throat swabs could be obtained from children who were "Schick negative" until twelve months had elapsed after immunization.

Dr. John Dale (Melbourne) stated that in Melbourne they had been steadily immunizing children since 1925. In the last eight years they had immunized more than one-half of the pre-school children. The incidence had fallen markedly. In the city of Melbourne they had had at least three-quarters of the baby health centre babies passed on to them for immunization by the time they were one year old. It was very important to secure the cooperation of the baby health centres. All children under ten had been subjected to the Schick test. Dr. Dale had never heard of severe reactions to the Maloney test. With regard to carriers, there had recently been an alarm in a country district, where the carrier rate was very high, though the strains were non-virulent. Among State children they had a carrier rate which was very low, 1% or 2%.

Dr. J. M. Dwyer (Adelaide) remarked that one did not see severe reactions to the Maloney test in children under five years of age.

Dr. F. V. G. Scholes (Melbourne), in summing up, referred to Dr. Finger's fear that, though the percentage of immunized children was high, it was not sufficiently high. He pointed out that one could not apply one figure to all communities, and spoke of Scotland, where an intensive drive had been carried out during the war years. A considerably higher figure for children under fifteen years of age (over 70%) was obtained there than elsewhere, yet in spite of this the incidence was 1,414 among immunized children, with six deaths. This showed that they could not fix a figure. As the number of immunized children grew, the remainder would be subjected to severe epidemics if diphtheria was reintroduced at any time. The 1936 epidemic in Melbourne had been almost entirely due to an *intermedius* strain and was not particularly severe.

Dr. Scholes was glad of the tribute paid by Dr. Dwyer to the work of R. L. O'Brien.

Dr. A. H. Finger agreed that Dr. Scholes was correct in saying that one could not set a level of Schick-negativeness needed before an epidemic of diphtheria ceased to be a possibility. Children who had been immunized in infancy should be subjected to a follow-up Schick test on entering school. Nurses who had developed diphtheria at Northfield Infectious Diseases Hospital had nearly always been "Schick-negative" previously. He did not see the necessity for Maloney tests in the case of children under eight years of age, but thought that this should be investigated further. It was of no use whatever talking of carrier rates unless the strains found had been subjected to the whole gamut of virulence tests.

Atypical Pneumonia.

Dr. E. G. Caughey (Auckland) described a series of cases of atypical pneumonia which had occurred among British and New Zealand troops at Caserta, Italy, between February and April, 1945. During a period of three months there approximately 350 patients suffering from the condition had been admitted to a neighbouring British hospital and 161 to Number 2 New Zealand General Hospital. Out of these 161, 50 consecutive cases were investigated in as much detail as possible, clinically and by serial laboratory and radiological investigation. The present report was based on these 50 cases. All degrees of severity were encountered. There were no deaths. The work described was a combined study by Majors Adams, Henley, Stanley, Rolleston and the speaker, and had been published in the *British Medical Journal* for February 16, 1946.

Dr. F. J. Fenner (Melbourne) stated that in a letter Dr. Topping, of the United States Public Health Service, had described an investigation in the case of a bomber group who suffered from this condition. Sera were investigated and positive complement fixations to "Q" fever were found in every case. Supporting evidence had been received from other sources in the Balkans and in Greece. Sandflies were present in the area where the bomber group was stationed.

Dr. J. M. Dwyer (Adelaide) described some cases of atypical pneumonia occurring in patients seen about twelve months previously at the 106th Australian General Hospital, Albury. In no instance was the onset abrupt. The cough preceded the pyrexia and was unproductive. There was anorexia and the pyrexia lasted about five days. During the stage of resolution, loud and definite rhonchi were audible for nearly a week after the fall of temperature. X-ray findings were clear after two weeks. They were very different from Dr. Caughey's cases.

Dr. F. V. G. Scholes (Melbourne) said that he had never seen an epidemic form of primary atypical pneumonia, but had heard of cases in New Guinea. He had always associated virus infections with a peculiar syndrome, which ran through the whole lot from smallpox to rubella, from terrific prostration as in smallpox down to vague pains as in early German measles. It seemed to him that Dr. Caughey's syndrome was much more severe than in the New Guinea cases.

Solar Photophthalmia (Sun-Glare Conjunctivitis).

Dr. J. M. Dwyer (Adelaide) described the appearance of solar photophthalmia occurring during the summer months among convoy drivers in the Northern Territory. The possible influence of dust and drying as causative agents was considered. The use of a strip of green paint to obscure the view of the sky had been shown to be efficacious in preventing this condition. This paper will be published in full in a subsequent issue.

Tick Typhus.

Dr. J. M. Bonnin (Adelaide) read a paper based on a joint report entitled "Tick Typhus in North Queensland" by Roderick Andrew, J. M. Bonnin and Stephen Williams published in The Medical Journal of Australia of August 24, 1946, page 253.

Dr. F. J. Fenner (Adelaide) described some studies on the strains of rickettsiæ isolated from patients suffering from murine typhus and North Queensland tick typhus, based on a paper by J. F. Funder and A. V. Jackson entitled "North Queensland Tick Typhus: A Comparative Study of the Rickettsiæ with that of Murine Typhus", published in The Medical Journal of Australia of August 24, 1946, page 258. The authors of this paper had expressed their indebtedness to Dr. F. J. Fenner for technical assistance with this work.

Dr. John Dale (Melbourne) thought cases of fever following tick bite had been reported in previous years, though, of course, they had not been investigated. He asked whether the patients described by Dr. Bonnin had a characteristic smell; and also whether it was necessary that the mice used in the experiments described should be fed on a deficient diet. There were not many diseases, susceptibility to which had been shown to be increased by vitamin deficiency.

Dr. F. V. G. Scholes (Melbourne) said that the authors appeared to have proved their case. Whether the rickettsia concerned occurred in other countries remained to be seen. He appreciated the knowledge gained by the authors of these papers at the cost of such laborious and intricate investigation. The value of this was perhaps not apparent at present, but it was only by the accumulation of such knowledge that progress could be made.

Dr. Bonnin, in reply to Dr. Dale, said that there were no references in the literature to cases of fever following tick bite. He had not noticed any characteristic smell. In regard to the mice used in his experiments, he had been fortunate in that the mice available happened to have been fed on bread and water; the colony later showed symptoms of vitamin deficiency. This undoubtedly increased their susceptibility; healthy white mice were almost insusceptible.

Dr. F. S. Hone (Adelaide) said that Dr. Bonnin and Dr. Fenner had opened up a new field of investigation. It would be a pity if work done because of the presence of the army in affected areas could not be followed up in peace time. The problem was how to stimulate practitioners to be on the alert for the diagnosis of such cases. It was a suggestive thought that the supposed vectors occurred all over the eastern States.

Dr. F. V. Scholes (Melbourne) asked whether the disease occurred only in jungle country.

Dr. F. J. Fenner (Adelaide) said that jungle country was not essential, only the host animal and the tick. In regard to diagnosis of suspected cases, the trouble was that there was no provision at present for the rather elaborate laboratory tests involved. Rickettsial work required a full-time laboratory, and workers in this field should devote their whole time to it. He believed that laboratory infections occurred most commonly in part-time workers. The new Queensland Institute of Medical Research should provide facilities for work on rickettsial diseases.

Perfusion of Organs and the Coagulability of the Blood.

Professor E. R. Trethewie (Adelaide) read a paper entitled "Studies on the Influence of Perfusing Organs on the Coagulability of the Blood". Diluted blood was used for perfusion and a small amount of heparin was added so that the fluid would not clot for some hours. When the isolated lung of the cat was perfused, it was shown that whereas blood from the cannula proximal to the lung clotted on standing, that which had passed through the lung did not clot, even after several hours. Similar findings were recorded for the liver. Estimations of the heparin content of samples before and after perfusion were approximately the same. There was a fall in prothrombin concentration of the blood after perfusion through the lung, but not through the liver. The calcium and fibrinogen contents of the fluid were unchanged after perfusion and there was little change in the protein. Platelet counts were only slightly diminished. The phenomenon, therefore, could not be accounted for by variations in the content of the well-known coagulant and anti-coagulant substances.

Since De Suto-Nagy had demonstrated an anti-coagulant of a lipo-protein nature in tissues, the active lipin fraction of the plasma was extracted after distillation to dryness *in vacuo*. The anti-coagulant remained in the protein residue which when reconstituted inhibited the coagulation of other coagulable blood. Quite clearly, therefore, an anti-coagulant substance was present.

Perfusion of the kidney had an even more striking effect. No coagulation of any degree was found in the perfused sample. The heparin content was slightly diminished, and there was in each instance a considerable fall in prothrombin content, which probably played some part in the loss of coagulability.

Perfusion of the isolated heart and brain, however, did not have the same effect; there was about equal clotting in the diluted blood before and after transfusion. It appeared likely, therefore, that the liver, kidney and to a lesser extent the lung released some anti-coagulant substance into the perfused blood, and that the heart and brain did not do this. Professor Trethewie suggested that the apparent inability of the heart and brain to liberate anti-coagulant might be related to the frequent occurrence of thrombosis in these organs. In another experiment the hind legs and pelvis

of cats were perfused, and the clotting time of the fluid was increased by perfusion; the experiments tended to show that there was an output of some clotting substance from the vessels of the hind legs. The spleen was shown to have the same effect on perfused diluted blood as the liver and kidney. It was thought that this experimental work provided some reasonable explanation of the infrequency of the occurrence of thrombosis in the liver, kidney and spleen and its frequency in the heart, brain, hind legs and pelvis.

Dr. J. E. Caughey (Auckland) asked whether thrombosis, coronary or cerebral, was known to occur in animals. In Auckland they had used dicoumarin in cases of pulmonary thrombosis. It would be interesting to try its effect in cases of cerebral thrombosis; the difficulty would be to distinguish thrombosis from hæmorrhage.

Dr. Leon Opit (Adelaide) asked whether the practice of advising movement of the lower limbs after surgical operations was based on sound premises.

Dr. P. Fantl (Melbourne) referred to a recent report that in patients with hæmophilia a first transfusion of blood was followed by a shortened coagulation time, but later transfusions had caused an increased coagulation time. He referred to the rare and puzzling disease called "pseudohæmophilia" occurring in female patients. Apart from heparin there were possibly other anticoagulants, the source of which was unknown, and which might be concerned in obscure hæmorrhagic disorders.

Professor Trethewie replied that there were as yet insufficient data on the incidence of thrombosis in animals. In reply to Dr. Opit, he said that it was difficult to know whether patients should be moved or not. Once thrombosis had occurred the incidence of embolism could be cut down from six per thousand to one per thousand by giving heparin. The incidence of the occurrence of pulmonary thrombosis in coronary disease appeared to have diminished in recent years; it would be interesting to know why. In reply to Dr. Fantl, Professor Trethewie said that some workers in America had carried out a full investigation of the increase of clotting time following repeated transfusions in hæmophilia; it had been stated that it was due to increase in the protein fraction of the blood.

Polychloronaphthalenes and Liver Necrosis.

Dr. J. M. Dwyer (Adelaide) described the case of a man who had died from liver necrosis and who had exhibited signs and symptoms consistent with polychloronaphthalene poisoning. The autopsy findings and pathological histology supported the conclusions drawn from the clinical findings.

Dr. Dwyer said that the case was the first of its kind to be reported in Australia, though references to similar conditions were found in the world's literature dating from 1933. Cases of a similar nature had occurred in Germany during the first world war in persons engaged in making perchloronaphthalene for synthetic rubber. Dr. Dwyer also described a second patient who had shown similar symptoms to the first one, but who had recovered. He suggested some possible methods of control and supervision of workers exposed to polychloronaphthalene and similar substances.

Dr. Dwyer's paper will be published in full in a subsequent issue.

Dr. A. R. Southwood (Adelaide) said that he had been very interested in the case history presented by Dr. Dwyer. The commentary was what was needed to awaken practitioners of medicine to the possibility of the occurrence of these industrial hazards. In regard to liver function tests, he agreed that normal results were often obtained in the case of patients with hepatic disease.

Dr. J. E. Caughey (Auckland) discussed recent work on the protective action of methionine in liver disease. Whipple's work had shown that the livers of animals could be protected from the action of certain drugs by the use of diets with a high protein content. Himsworth, in England, had used methionine successfully for the same purpose. While in the Middle East, Dr. Caughey had wondered whether the administration of methionine would benefit patients with infective hepatitis. In Italy in 1945, he had treated such patients with diets containing large quantities of skim milk and cheese, in the hope that the methionine contained in these foods would prevent liver damage. He and his colleagues had thought that such patients showed less loss of weight than others not so treated. In another New Zealand army hospital, however, it had been observed that patients with infective hepatitis on diets with a high methionine content showed a greater degree of liver enlargement than usual. Workers at Radcliffe Infirmary, Oxford, had not been impressed with the value of methionine in infective hepatitis, though it appeared to prevent liver damage in persons exposed to toxic substances. Factory workers exposed to such substances might be helped by an insistence on diets with a high methionine content, and cheese would be better for this purpose than skim milk.

Dr. P. Fantl (Melbourne) asked whether any prothrombin estimations had been made in Dr. Dwyer's two cases. A decrease in the prothrombin content of the blood was one of the earliest indications of liver damage. Such tests could be performed on factory workers exposed to toxic substances. He was interested in Dr. Caughey's suggestion about skim milk and cheese, but asked why pure crystalline methionine should not be used.

Dr. Beatrix Durie (Sydney) pointed out that methionine was extremely expensive and difficult to obtain.

Dr. Caughey (Auckland) recalled having read of an acute case of carbon tetrachloride poisoning which had been successfully treated by methionine administered intravenously. With regard to liver function tests, he thought that the cephalin flocculation test gave the earliest indication of impairment of liver function.

Dr. Dwyer, in reply, said that prothrombin estimations had not been performed in his cases. The autopsy in the first case had shown petechial hæmorrhages in the heart wall. Hæmatemesis was common in any advanced liver disease. Veterinarians were not enthusiastic about results obtained with methionine.

Studies in the Salmonellas.

Miss Nancy Atkinson (Adelaide) gave an account of her work on salmonellas occurring in Australia and New Guinea.

First she described the technical procedures and difficulties in identifying an organism as a salmonella and determining its type. For this purpose a typing centre had been established at the Institute of Medical and Veterinary Science in Adelaide. Lists of salmonellas so far received and typed in Adelaide were presented. Nearly 500 cultures had been typed and a wide range of types was found to occur. Particularly interesting were strains of the rare types *Salmonella adelaide* (described there in 1943), *Salmonella mississippi*, *Salmonella oslo* and *Salmonella blegdam*, and a group of cultures belonging to a new type closely allied to the Z_4 paracolons, a group not previously shown to cause human disease. The Australian group of this type was isolated from an outbreak of food poisoning in a military camp on the Atherton Tableland. The name *Salmonella atherton* was suggested for them, and this was the first record of their association with human disease. The importance of determining the type of salmonella lay in the epidemiological application of the knowledge.

Salmonella blegdam, a very rare type, was found in severe cases of enteric-like fever occurring in New Guinea and Bougainville Island in natives, Australian soldiers and a Japanese prisoner-of-war. This organism fell into the same O group as the typhoid bacillus, and therefore one might expect that "TAB" vaccine would offer protection against *Salmonella blegdam* infection. The vaccine obviously did not offer protection to Australian troops, and in an endeavour to detect the reason for this failure the blegdam strains were tested for the presence of the heat-labile virulence antigen, known as Vi antigen, typhoid and paratyphoid B typing Vi-phages being used. The phage technique indicated that the blegdam cultures contained a Vi antigen related, not to that of the typhoid bacillus, but to that of the paratyphoid B bacillus. The tests also gave an indication of Vi types of *Salmonella blegdam*. Here then was the probable explanation of the failure of "TAB" vaccine to give protection against *Salmonella blegdam* infection. The discovery of Vi types of *Salmonella blegdam* provided an important contribution to the methods of study of the epidemiology of this infection.

An Experiment in Nutritional Education.

Miss Shoobridge, of the Australian Red Cross Society, described an experiment in the use of scientific nutritional knowledge.

The Commonwealth Health Department, with the assistance of the Nutrition Committee of the National Health and Medical Research Council, had conducted household food consumption surveys in Australia in 1936 and 1944. The report of the first survey had stated that there was much ignorance in the community as to the proper balance of food items, and that some people in both town and country were unable for various reasons to obtain the essential fresh foods. The survey of 1944 showed similar results.

In May, 1943, the Australian Red Cross Society had offered its resources to the Commonwealth Government to aid in the dissemination of knowledge of nutrition.

During 1943 many classes had been conducted for Red Cross personnel in Melbourne and Sydney and a few in Brisbane, Perth, Adelaide and Hobart during 1944, with the assistance of doctors and dieticians who acted as voluntary lecturers. In 1944 the work was extended to rural areas. By the cooperation of the Commonwealth Department of Health, the State Nutrition Councils and the Red Cross Division in each State, the sphere of activity was gradually increased.

Miss Shoobridge gave a detailed description of a campaign conducted in Tasmania from February to May, 1946, in which the food position had been shown to be less satisfactory than in any other State. She also referred to two nutrition education experiments in Victoria, one at the outpatient department of the Royal Melbourne Hospital, the other in opportunity clubs working among children in industrial areas of Melbourne.

To sum up, Miss Shoobridge said that the work undertaken by the Red Cross during the previous three years had touched only the fringe of the problem, but valuable information had been acquired as to the best way nutrition education could be given.

The Next Step against Tuberculosis.

Dr. John Dale (Melbourne) gave an address entitled "The Next Step against Tuberculosis". He commented on mass radiography and the use of micro films, on increased public interest in the problems of tuberculosis and the demand for more vigorous action. Forty years previously infection with tuberculosis, in some degree or other, had been almost general, but there was clear evidence that this widespread incidence was diminishing. In his opinion tuberculosis was not so much a disease as a symptom, a symptom of ill health. A healthy person could withstand infection; but overwork, worry, malnutrition, exposure to cold and so on might allow tuberculosis to develop. There was a marked and definite social incidence, and economic factors played a large part; tuberculosis was common, for instance, among drinkers and ne'er-do-wells. There was an occupational distribution, especially in workers exposed to quartz dust; and geographical factors played a part, in that tuberculosis seemed more common in bleak, cold and windy regions; perhaps this was bound up with the economic factor.

It followed then that the next step against tuberculosis was to attack the conditions which predisposed to it: to elevate the poorest classes to the state of the well-to-do. It was not a case of building more sanatoria, but of making every home a sanatorium. In Dr. Dale's opinion, the diminishing incidence of tuberculosis was due to improved housing conditions. He referred to the effect of war on the tuberculosis rate: the war-time increase in Anglo-Saxon countries had not been nearly so great as that seen in the continent of Europe. Dr. Dale did not think an antibiotic was really what was needed. Active tuberculosis was a penalty for ill health. If it was eliminated, Nature might devise something else in its place. Facilities for more radiography made it easy and cheap to discover people who were likely to be carriers, but this procedure had to be used intelligently, without compulsion or over-optimistic promises. Other weapons against tuberculosis were allowances to affected families, community measures to assist patients with arrested and partly healed lesions, including colonies of the well-known Papworth type (but not too many of them), and well-informed publicity, spread continuously by some agency such as the State Health Department.

Dr. F. V. G. Scholes (Melbourne) said that no one would quarrel with Dr. Dale's views about the influence of economic and social conditions on tuberculosis, but the community had yet to learn a practical method of eliminating poverty. The session should perhaps have been a joint meeting with the economics section. Family allowances, sanatoria and tuberculosis settlements all had their place, but there was still no completely satisfactory method of dealing with persons infected with tuberculosis.

Dr. A. R. Southwood (Adelaide) agreed with Dr. Dale on many of the points he had raised. With regard to the incidence of tuberculosis, the irreducible minimum which could be attained with the weapons at present available had not yet been reached. Unlike Dr. Dale, he thought that some measure of compulsory segregation might be advisable, though it was unnecessary provided ordinary measures of control and supervision were carried out. The wrong sort of publicity might do harm; perhaps one of the things that Dr. Dale feared might replace tuberculosis was anxiety neurosis. Unnecessary ostracism might add to the sufferer's unhappy lot.

Dr. H. K. Fry (Adelaide) said that improved housing conditions had led to the disappearance of typhoid, typhus and cholera, but in spite of improved conditions there were still 200 deaths from tuberculosis every year in South Australia. Those two hundred people were important; it would be an achievement to be able to save them. Of persons in the age group between fifteen and forty-five years, 1% had active tuberculosis. Some elderly people with chronic coughs were active disseminators of tubercle bacilli. Dr. Fry deprecated compulsion, but thought that this incidence could be reduced by active methods of persuasion and enlightenment.

Dr. Dale said that typhoid, typhus and cholera were diseases spread by insanitary conditions, but were not due to the ill health of sections of the community. He quite agreed about the importance of discovering the person who did not know he was a carrier. His previous remarks had not referred to healthy persons who had encountered an overwhelming dose of infecting organisms or to very young children.

Miss Nancy Atkinson (Adelaide) asked Dr. Dale his opinion of "B.C.G." vaccine for the prophylaxis of tuberculosis in young adults.

Professor S. D. Rubbo (Melbourne) said that he had always been impressed by Dr. Dale's philosophical approach to disease. He thought that Dr. Dale had passed lightly over the matter of familial susceptibility. In America the principle of examining contacts had been extended to the examination of relatives as well, even if they had not been contacts. Some American statistics appeared to show that relatives, even though living under different conditions, were more likely to be affected than contacts. He also pointed out that there was a comparatively high incidence of tuberculosis among medical students and nurses, although their living conditions and diet were on the whole good.

Dr. Dale said that he had not seen any good work on familial incidence in tuberculosis, but would be glad to do so. The effect of diet was an open question. He himself laid great stress on diet, but many people did not think the question was settled.

Dr. Scholes compared the effect of familial incidence in tuberculosis to that seen in rheumatic heart disease, where familial susceptibility, though important, was a less important factor than economic conditions.

Professor Rubbo said that the statistics of familial incidence to which he had referred were those for the County of Williamstown, United States of America, for the years 1931-1941. He thought that the discovery of a chemotherapeutic treatment of tuberculosis would be advantageous; the patient would regain his health as a result of the elimination of the organism causing the disease. The patient's ill health was at least as likely to be the result as the cause of the disease. Work done in Oslo had shown that nurses who had not previously reacted to the Mantoux test did react to it after the administration of "B.C.G." vaccine, and that there was a lower incidence of tuberculosis among nurses so treated. He thought that there was reason to proceed with the use of "B.C.G." vaccine as a prophylactic.

Dr. Fry said that the comparison of typhoid fever and tuberculosis was permissible. Typhoid fever had practically disappeared; an occasional outbreak occurred and could be traced to a carrier. The position in regard to tuberculosis was comparable—it was an infectious disease, with foci of infection in the community which should be traced and properly dealt with.

Dr. Dale replied that typhoid was an acute disease, tuberculosis a chronic one. The tracing and isolation of carriers in typhoid was a very different problem from that of tuberculosis.

Antibiotics.

Miss Nancy Atkinson (Adelaide) gave a short account of the discovery and development of antibiotics. She referred to an antibiotic isolated at the Institute of Medical and Veterinary Science, Adelaide, to which the name of penicidin had been given. Subsequent work had shown that this was identical chemically with patulin and also with clavicin, substances described independently by workers in England. She discussed the question of searching for new antibiotics, and in particular the search for antibacterial substances produced by fungi and by flowering plants, which was being carried out at present at the Institute. A preliminary survey had been published in *The Australian*

Journal of Experimental Biology and Medical Science, Volume XXIV, 1946, page 49.

By the cylinder-plate method 450 types of flowering plant, mainly natives of Australia, had been tested for antibacterial activity against *Staphylococcus aureus* and *Bacterium typhosum*. Only ten species had shown any activity; three species of *Persoania* (berries) had affected both *Staphylococcus aureus* and *Bacterium typhosum*. By the cylinder-plate method of Heatley 240 different members of the higher fungi had been tested for antibacterial activity against *Staphylococcus aureus* and *Bacterium typhosum*. The majority were toadstools or mushrooms and only seven showed any antibacterial action; all seven were active against *Staphylococcus aureus*, but only three were active also against *Bacterium typhosum*. Those active only against *Staphylococcus aureus* were three new species of *Cortinarius* and an unidentified species of yellow clavaria; those active also against *Bacterium typhosum* were *Cortinarius rotundisporus*, *Psalliota xanthoderma* and *Amanita acrophylla* of a variety which was called warty cap.

Hæmoglobinometry.

H. F. Holden (Melbourne) gave a brief survey of the various methods of colorimetric determination of the blood pigment; their relative advantages and disadvantages were indicated. An account was given of the tests of performance of a simple Australian-made photoelectric hæmoglobinometer.

The acid hæmatin method compared unfavourably with regard to accuracy with other ways of estimating hæmoglobin. It had, however, the advantage of simplicity and convenience, and as it was the method customarily employed in Australia, Mr. Holden offered some suggestions for its improvement. He did not think that 20 cubic millimetre pipettes could be used with sufficient accuracy to avoid a scatter of results. Pipettes to contain 50 cubic millimetres would be much better. Whatever pipettes were used should conform to British standards, and each pipette should be numbered and marked with its true capacity to within 0·5%. Dilution tubes should be calibrated, numbered and certified. The Commonwealth Serum Laboratories should make standard specimens of a blood pigment derivative available for purchase. With regard to the actual determination, a standard procedure should be laid down and those in charge should insist that it be meticulously and rigorously followed. Only in this way could reliable results be obtained.

Dr. R. Lemberg (Sydney) said that he looked at the situation from a slightly different point of view from Mr. Holden. Hæmoglobinometers were often brought to him to be standardized. The inaccuracy found was sometimes as high as 20%. The error due to the instrument was in such cases much greater than the inaccuracy of the acid hæmatin method. He thought that the rigid standardization of all such instruments should be insisted on before they were offered for sale. The acid hæmatin method had its drawbacks, but it appeared much worse than it really was, because of the Sahli apparatus in which it was used. Another factor was the error inherent in all dilution methods. At the Kolling Institute at the Royal North Shore Hospital, Sydney, a spectrophotometer was available for checking hæmoglobin estimations. An oxyhæmoglobin solution was used. Dr. Lemberg said that he would rule out any method based on the estimation of iron, since all the iron present in the cell was not always in the form of hæmoglobin. The clinician might need to use some judgement in interpreting the results of hæmoglobin estimations. Most of these measured the total hæmoglobin, so that in certain conditions physiologically inactive compounds, such as methæmoglobin and sulphæmoglobin, were included in the hæmoglobin value.

The Scientific Principles Underlying Chemotherapy and Pharmacology.

A joint discussion on the scientific principles underlying chemotherapy and pharmacology was held by Sections *I*, *N* and *O*. The discussion was opened by Dr. Adrien Albert (Sydney), who gave an address entitled "Therapeutic Interference—a Two-Edged Weapon".

Dr. Albert said that many of the most successful forms of preventive and curative medicine were actually cases of interference. In using sulphonamides to treat septicæmia, for instance, man was attempting to interfere with the utilization of *p*-aminobenzoic acid by the invading bacteria which required it as a building block to make pteroic acid, one of their most important metabolic tools. Looking further afield, one saw as interference the use of a slightly pathogenic strain of a virus to protect plants against infection with highly pathogenic strains of the same virus (a similar effect had occasionally been obtained with some animal viruses). In both of these cases the interference was due to a large measure of chemical similarity between the biologically active agent and the host-protecting agent.

"Therapeutic interference" and "chemotherapeutic interference" were names applied to a more sinister phenomenon, for they referred only to such example of interference as were contrary to the host's welfare. An example was the interference by ascorbic acid with the trypanocidal action of arsenicals, antimonials and acridines in infected rats.

The phenomenon of therapeutic interference was discovered in 1922 by Browning and Gulbransen, who had been using "Trypaflavine" to cure mice infected with a strain of trypanosomes that were fast to parafuchsin. They had observed that the cure did not take place if there was any parafuchsin circulating in the animal's blood, and they concluded that the parafuchsin blocked the receptors (in the trypanosomes) that would normally take up the "Trypaflavine". Thus a potent drug had been prevented from acting by a chemically inert substance given at the same time. Four years later, Schnitzer had shown that it was not necessary to use a parafuchsin-fast strain; all that one had to do was to inject the parafuchsin and "Trypaflavine" at the same time, and the latter could be depended on not to exert its normal curative action. This author, along with Silberstein and Rosenberg, had shown that other triphenylmethane dyes besides parafuchsin exerted therapeutic interference, and that they exerted it not only against acridines (such as "Trypaflavine"), but also against arsenicals and antimonials. However, one triphenylmethane did not interfere with the action of another one.

That interference really was some form of competition between the drugs for the parasite had been shown in 1935 by Hassko, who found that trypanosomes, in animals treated with a triphenylmethane dye, failed to take up the normal amount of "Trypaflavine", and this had been confirmed by von Jancsó (1931) using another analytical technique.

The drug-resistance studies of Yorke, Murgatroyd and Hawking (1931); von Jancsó (1931); Reiner, Leonard and Chao (1932) and Fischl and Singer (1934) left no reasonable doubt that the trypanocidal actions of arsenic, antimony and "Trypaflavine" depended on their being taken up by the parasite.

Hence it must be concluded that, in trypanosomiasis, triphenylmethane dyes interfered with therapy by preventing the parasite from taking up the drug.

But how did this interference operate? It would probably be easy to answer this if one knew exactly how the chemotherapeutic substances worked. Some knowledge of this kind was available, but not enough. In fact it might be more expedient to press for a better understanding of the phenomenon of therapeutic interference so as to use it as a biological tool for investigating the mode of action of curative drugs. Parallel investigations should bring mutual aid, and much more research ought to be planned along these lines. Many interfering substances had a weak chemotherapeutic activity of their own.

The principal hypotheses covering the phenomenon of therapeutic interference were then outlined.

In conclusion, Dr. Albert said that therapeutic interference was not only a valuable scientific tool; it was also the cause of frequent therapeutic failures in everyday medical practice. These facts made it a two-edged weapon and constituted two good reasons for studying it.

Dr. F. H. Shaw (Melbourne) then discussed the mode of action of alkaloids, with special reference to adrenaline and quinine. The material used was the action of quinine, calcium, adrenaline, yohimbine and other alkaloids together and separately in the body. He also spoke of the actions of some tertiary compounds and their corresponding quaternary derivatives. The group responses of the body to these substances of different ionic properties were very interesting.

Professor S. D. Rubbo (Melbourne) said that of the countless antibacterial substances of synthetic and biological origin only a few were effective in chemotherapy. It was of interest therefore to try to decide on what property or combination of properties chemotherapeutic activity was determined.

A chemotherapeutic substance might be defined as one which interfered with the growth of parasites *in vivo* without exercising any significant damage to the host or host cells. This definition implied a study of two systems, one the drug-parasite system and the other the drug-host system.

A prerequisite to any prediction of in-vivo activity is a knowledge of in-vitro action. Unfortunately, there was no

internationally recognized method of assessing the in-vitro activity of an antibacterial agent, so that it was frequently impossible to compare results coming from different laboratories.

In general, two main methods were used in determining bacteriostatic activity. The first was the serial dilution method in which the highest dilution of the substance capable of inhibiting organismal growth in suitable media was noted. The second method depended on the ability of the substance to diffuse from a solution contained in a small cup resting on an inoculated agar surface and measuring the zone of inhibition of growth. This was the Oxford cup assay. With few exceptions those working with synthetic chemicals chose the serial dilution technique, whereas those working with antibiotics used the cup assay. Both techniques were subject to abuse in the sense that details of procedure might be so arranged as to encourage over-optimistic estimates of antibacterial activity.

The principles governing the serial dilution method might be briefly dealt with by describing experiences in the assay of over 400 substances.

Variables for consideration were: (*a*) the medium; (*b*) the organism used; (*c*) the size of inoculum; (*d*) the incubation period; (*e*) the interpretation of results.

The cup assay with which Professor Rubbo had had but little experience was of great value in determining the concentration in units of substances like penicillin and streptomycin and was convenient in determining the presence of inhibitors of unknown concentration and unknown nature in extracts of plant and other tissues and in mould metabolism solutions. It was of no value in comparing drugs of known chemical constitution. Further, it could frequently be misleading to the naturalists, as had been instanced in recent work at Oxford. Osborn (1943) had examined extracts of 2,300 plants of which *Spirea aruncus* was selected on the cup assay as chemotherapeutically promising. Further work on the purification of the antibiotic from this plant disclosed, however, that the active principle by the serial dilution technique inhibited *Staphylococcus aureus* in concentration of only 1 in 4,000. This low activity discouraged any further work on its chemotherapeutic potentialities.

Apart from the basic tests already mentioned, other workers, particularly Americans, had chosen more oblique methods of determining antibacterial activity. For example, the influence of the drug on metabolic events such as oxygen uptake, carbon dioxide production, acid formation, luminescence *et cetera* had already been tried and Professor Rubbo thought discarded. The measurements could be grossly misleading—streptococci took up oxygen in the presence of growth-inhibitory concentrations of sulphanilamide; staphylococci respired in the presence of penicillin. *Photobacteria* glowed in the presence of toxic concentrations of gramicidin *et cetera*. In short, the results were more striking for their lack of correlation with chemotherapeutic activity than for their correlation with it.

Tests of bactericidal activity were not as frequently performed as tests of bacteriostatic activity, because the most important information required about the action of a drug *in vitro* was the inhibitory or bacteriostatic capacity. It was assumed that the action of the drug *in vivo* was predominantly bacteriostatic. Other reasons included the technical difficulties associated with the bactericidal tests, particularly when large numbers of compounds were being investigated simultaneously. Professor Rubbo recommended a simple method used in his laboratory, which consisted of suspending the test organism in fluid containing the inhibitory dilution of the drug, and taking samples at intervals, with a Pasteur pipette graduated to deliver fifty drops per cubic centimetre. At each sampling, a drop of the inoculated material was transferred to a predetermined area of blood agar or suitable medium for inoculation. In one instance, increase of the concentration of the chemotherapeutic agent actually appeared to diminish its bactericidal action. Further experiments of a desirable and informative kind on the action of chemotherapeutic agents *in vitro* were suggested, namely: the examination of activity against a wide range of bacterial types; the determination of the influence of serum, lipoid, pH, oxidation-reduction potential, +thiol-groups, *p*-aminobenzoic acid, urea and tissue extracts on bacteriostatic activity and the determination of the ease with which drug-fastness might be induced.

J. E. Falk (Sydney) spoke about the technique of investigations of the drug-enzyme relationship. The results of such studies were difficult to correlate when they came from different schools because there was no international standard technique. It was especially difficult when competitive inhibition was being investigated. He described a mathematically sound method of assessing results which would make quantitative comparison possible. Studies of the drug-enzyme relationship would eventually reveal the finer details of the mode of action of many drugs, but such studies could not be divorced from studies of the drug-parasite drug-host relationship.

A speaker referred to the persistence of drug resistance in succeeding generations of organisms, and asked what were the grounds for asserting that it was permanent in any given strain of organisms. For how many generations did it persist? Had there been any investigations of drug resistance in metazoan parasites?

Professor S. D. Rubbo (Melbourne) said that there was no doubt that drug-fastness occurred and that it could be either permanent or temporary.

Professor R. D. Wright (Melbourne) said that the matter of a cell becoming adapted to an environment or to the presence of a chemical was a very general one. He instanced the adaptation of morphine addicts; and also referred to adaptive enzymes, mentioning the presence in the intestine of enterokinase and disaccharidase, which, one had formerly been led to believe, existed there from birth. It had now been shown that if an animal had never ingested sugar, the amount of invertase present was undetectable. Certain instances of adaptation to food were among the best proved examples of the transmission of acquired characteristics. The chemists were trying to "tailor" chemotherapeutic agents to fit bacteria, but much work needed to be done before this ideal could be attained. The reproduction rate of bacteria was very rapid; it was possible that chemotherapeutic agents interfered with an enzyme system concerned with reproduction, rather than with the processes concerned with existence. He wondered whether, for instance, the implantation of a fœtus could take place in a guinea-pig taking full doses of a sulphonamide drug. In the experiments described by Dr. Albert, in which ascorbic acid interfered with the trypanocidal action of arsenicals in infected rats, it was possible that the trypanosome required ascorbic acid for reproduction, though not for existence. In the absence of ascorbic acid, the drug might interfere with the reproduction of the trypanosome and therefore exert its full effect.

Dr. R. Lemberg (Sydney), referring to Mr. John Callaghan's paper on "The Production of Aromatic Acids by Bacteria Adapted to Sulphathiazole", said that a strain of *Bacillus coli* which had become sulphathiazole-fast had not produced para-aminobenzoic acid. This suggested that it had become drug-resistant by some other means. Transferred to a medium which did not contain sulphathiazole, the organism had developed a new type of indole metabolism, producing anthranilic acid, though it had not done this in the medium containing sulphathiazole.

Professor Rubbo (Melbourne) said that even in a simple organism such as *Bacillus coli*, there were at least 100 enzymes; it would be difficult to say which were required for reproduction. It was possible that by a knowledge of the chemistry of the drugs one might arrive at a knowledge of the chemistry of the organism.

E. L. French (Adelaide), referring to some experiments mentioned by Professor Rubbo, said that Chick and Martin, in 1918, had published experiments showing that the relationship between the concentration of a disinfectant and its effect on a bacterium was not a simple but an exponential one and varied with different disinfectants. He also referred to the work of Henry and Sevag, who had doubted the Woods-Fildes theory.

Dr. A. Albert (Sydney) said that the work of Sevag was not well regarded. Recent disclosures of the presence of para-aminobenzoic acid in the molecule of pteroic acid made it seem likely that para-aminobenzoic acid was an essential metabolite. He did not think that the work of Chick and Martin, quoted by Mr. French, had any direct bearing on Dr. Rubbo's experiment, in which an increased concentration of a drug had shown a diminished bactericidal activity. The argument of Henry that para-aminobenzoic acid was not an essential growth factor did not necessarily preclude its importance as an antagonist to sulphonamides. Dr. Albert paid a tribute to Professor Rubbo, who had been the first person to isolate para-aminobenzoic acid from yeast cultures.

Dr. Lemberg (Sydney), referring to the subject of his previous remark, said that the development of a new type of indole reaction, producing anthranilic acid by a strain of *Bacillus coli*, had at first appeared to Mr. Callaghan and himself to lend some support to Sevag's work, but as anthranilic acid was not developed in the medium containing sulphathiazole, it could hardly be concerned in the develop-

ment of drug resistance in this case, nor did these experiments necessarily detract from the importance of the Woods-Fildes theory.

Dr. Gottschalk (Melbourne) asked Dr. Albert whether the problem of permeability had been considered in relation to interfering substances. It undoubtedly played a part when one was dealing with whole cells. For instance, when yeast cells were incubated with either glucose or mannite, fermentation occurred; if a mixture of glucose and mannite was used, only the glucose was fermented. Yet when a yeast extract (not the whole organism) was used with a mixture of glucose and mannite, both sugars were fermented. Clearly this was a problem of permeability of the cell membrane. Similarly, drugs might compete for the permeability of the cell membrane.

Dr. A. Albert (Sydney) said that the whole subject of therapeutic interference was a huge one. Undoubtedly the question of permeability was a factor. He thought that exhaustive studies of some pairs of interfering substances should be made. It was because of the complexity of the subject that one advocated fundamental studies as opposed to work with whole tissues. Fundamental studies, carried out from a purely scientific point of view, would eventually lead to results of practical value. At the same time empiricists were needed to provide—if the use of the word in this connexion was permissible—serendipity.

F. Draper (Adelaide) agreed with Dr. Albert in his advocacy of fundamental studies, but, as a physiologist, felt that one must not over-simplify these things. Referring to the work described by Dr. Shaw, he said that a fall in blood pressure might be caused by drug action at almost any point in the central nervous system. The point of action of even well-known drugs was still a matter of doubt. In pharmacology there was a grave danger of assuming that drugs must act at a certain point.

Dr. Shaw admitted that Mr. Draper had seized on a vulnerable spot in his work. The studies on the influence of drugs on blood pressure were not yet complete.

Professor R. D. Wright (Melbourne), referring to the Woods-Fildes theory, drew an analogy between para-aminobenzoic acid in relation to bacteria and ascorbic acid in relation to the rat. The rat required ascorbic acid, but did not need to take it in its food as it was a product of the rat's metabolism. In the same way, the bacterium might require and provide its own para-aminobenzoic acid.

Dr. A. Albert said that Fildes, foreseeing this suggestion, had said that it was likely that the para-aminobenzoic acid and similar substances played the part of hormones to some organisms and vitamins to others. Summing up, he said that there had perhaps been a note in the discussion suggesting that the chemists were taking over the subject of chemotherapy. This was not so. Chemists could help, but it must be remembered that the subject was fundamentally a biological one.

Professor R. D. Wright paid a tribute to the three principal speakers and to others who had taken part in the discussion.

Education in Australia.

Professor G. S. Browne (Melbourne) in his presidential address to Section *J* discussed the subject "Is Progressive Education Shackled in Australia?" He asked what was meant by progressive education and said that it was learning by living. It was education which was described by the English Ministry of Education as being "thought of in terms of activity and experience rather than knowledge to be gained or facts to be stored". It was education in which there was a purposive aspect from the pupil's point of view. It was not a situation in which traditional subjects were put above challenge by scientific method. This meant schools which were happy democratic communities, full of interest and reality and activity, where the educational programme was fitted to the children and not the children to the programme. It meant less oral teaching and more pupil activity, investigation, group activities and cooperative work. It did not involve any sacrifice of thoroughness, but it meant a psychological approach to the work rather than a traditional approach. In Australia at present there were many good examples of progressive education and its principles were beginning to permeate all school work. But too much oral teaching was still used and the viewpoint was too traditional.

Professor Browne then asked what were the shackles. He described five.

The first had to do with the type of educational administration in Australia. The Australian centralized system had many achievements to its credit, but it tended to standardize and stereotype courses and procedure. It was by nature authoritarian and did not encourage freedom. It tended to keep education to itself; there was not enough publicity, no real attempt was made to sell education to the community and to encourage local interest.

The second shackle was uncertainty about educational objectives. The community did not seem to have any sense of educational objective, and was not sure what was being attempted. If an attempt was being made to develop in Australia a genuine social democracy, Australian schools needed much more freedom for both teachers and pupils.

The third shackle was lack of essential equipment and amenities. Only the church schools seemed to be able to have small classes. With large classes progressive education was almost impossible. State schools often were badly in need of libraries, school assembly halls, good playing fields, hygienic equipment, beautiful surroundings.

The fourth shackle was dominance of examinations. Nursery schools expressed the principles of progressive education very effectively. Primary schools were moving steadily in that direction. But the secondary schools were still worshippers of the goddess of examinations. There were many liberal movements afoot, but, when a comparison was made with the situation in England and Scotland, Australia had still a lot of shackles to knock off.

The fifth shackle was lack of teachers. Nothing could be done without a plentiful supply of enthusiastic and capable teachers, carefully recruited and trained. Australia was not getting them. The services were too standardized with seniority lists shackling the bright young adventurous spirits. It was necessary to make provision for rapid advancement of brilliant younger men and women. Then, with a new charter for teachers, a recruiting campaign should be started for more teachers and for a better consideration of them by the community.

Professor Browne then made some suggestions.

First for the psychologists. Educational psychology had done excellent work in measurement, aptitude tests and the study of atypical children. But it had not given much of a lead in the social psychology of education—what a teacher should know about the emotional reactions and behaviour problems of adolescents, for example. Could psychologists give more information about the psychology of good teaching, of progressive methods of presenting material? Less emphasis was needed on clinical and statistical psychology and more guidance for the teacher about that very important person, the average boy or girl.

Secondly, for the federal office of education, Professor Browne said that there should be all-Australian summer schools for teachers from all States dealing with progressive methods in all fields of education. These would have a far-reaching influence. They could be held in each State in turn.

Thirdly, for the federal office of education, Professor Browne suggested that on the general plan of the Army and the Royal Australian Air Force schools of administration, there should be established a school of educational administration. At present educational administrators grew up within their own service, stage by stage, attaining a responsible post late in life; they would not alter the system very much. A school of administration, surveying the best procedures in all progressive countries, might encourage that flexibility and freedom which Australian systems at present needed.

University Decentralization.

J. D. G. Medley, Vice-Chancellor of the University of Melbourne, in an address to Section *J* entitled "To What Extent is University Decentralization Feasible?" outlined the proposed experiment to be undertaken at Mildura by the University of Melbourne. The first-year students of the faculties of medicine, dentistry, architecture, science and engineering would be accommodated there.

Mr. Medley described four different methods of decentralization. The first was the establishment of a university college giving complete degree courses; the second consisted of a university branch catering for detached years of existing courses; the third was the founding of a complete new university; and the fourth a university branch giving a detached course *plus* additional preliminary training. He emphasized the prominence given to the consideration of all such plans now that the pressure in the universities had become so great and expressed the opinion that since universities must become increasingly dependent upon government funds, it would be a great pity if there was

to be a great diversion of such funds to decentralization experiments, as these could be better spent in the decentralization of existing schools. In his opinion, there was no ideal size for a university. The whole thing depended upon the resources of the university and its power to attract men of first-rate ability to its staff.

Mr. Medley ridiculed the idea that the process of decentralization should be adopted so as to benefit country dwellers, handicapped by their distance from centres of learning. He contended that such a policy would result in a measles rash of universities scattered throughout the country, and that, in any case, brilliant students would still continue to come to the central university.

Referring to the argument often put forward that Australia should have more universities, Mr. Medley stated that the strength of this argument depended entirely on whether or not the community would absorb new institutions and use existing universities for training. Australian universities were predominantly professional schools, and it was open to mild doubt whether the community could absorb those people who were in training at the present time. The medical men of the future might be forced to "take in each other's goitres". As a result, it might be possible that more universities of the same kind were not needed, but more universities of a different kind. This different kind of university, Mr. Medley suggested, should be an institution which would counteract the present insistence on technical and professional training by giving that "humane education" which should be at the back of every complete citizen, and it was just possible that the Mildura experiment might provide the beginning of such a system.

It would be interesting to see whether it would be possible to teach first-year subjects to a satisfactory standard away from a central university and in surroundings less elaborate than people had been led to believe were necessary. In any case, Gothic architecture and the atomic age went ill together.

It would also be interesting to see whether the year in a closely knitted community, away from home and far from city distractions, would inculcate in the students a sense of responsibility which young people of the present day tended to lack. There was a good deal of evidence from returned service people that their life over the previous five years had strengthened them in this direction.

In conclusion, Mr. Medley considered that if they were not satisfied that these conditions had been met by this experiment, it should be assumed that the time for decentralization had not arrived, but if they were satisfied on all counts they might be able to arouse sufficient public support to make it worth while going ahead along similar lines on a large scale.

Dr. K. S. Cunningham (Melbourne) expressed the opinion that if the Mildura experiment erred at all it was on the side of safety. It would, however, seem that the students would gain a lot and might do better through the absence of distractions. The experiment might affect the future development of university life. The geographical element should be considered in Australia and a full three-year type of university might not be justified in certain of the States. Dr. Cunningham saw no reason why Australian universities should not be much larger than at present, without vertical decentralization. He considered the total economy of the country owed so much to what a university made possible that the expense was justifiable.

In reply to questions as to how the isolation felt at Armidale, owing to difficulties in meeting and having discussions with people of similar cast of mind and interests, would be overcome at Mildura, and what provision would be made for science teachers, who required to carry out research work while teaching, Mr. Medley explained that the only solution for overcoming isolation would be to allow staff members, senior and junior, to fly from the main university to Mildura and *vice versa*, twice weekly. The difficulty with regard to research facilities for science teachers was not solved as yet, except, perhaps, in the case of botanists and zoologists, who might find their material locally.

Dr. H. H. Penny (Adelaide) stated that there were 11,000 boys and girls in secondary public schools in South Australia with a resulting constant demand for higher knowledge. At present there was difficulty on the part of the universities in providing this knowledge. If the numbers to the universities were increased, then the graduates in turn could staff more universities. Owing to the impoverishment of country life he would like to see an extension of universities, but only provided that the standard was kept up.

Professor G. S. Browne (Melbourne) expressed the opinion that too much apathy on the part of students was met with at the present time in university affairs—even of a sporting nature. It might be that the best conditions for the fostering of *esprit de corps* were to be found where there were rival universities in pairs, such as Oxford and Cambridge, Yale and Harvard, Stanford and Berkeley. It would be interesting to see whether more affection for the university would result at Mildura than at some of the present universities.

The Educational Opportunity.

H. H. MacNeil, a former Rhodes Scholar and the late Headmaster of Wesley College, Melbourne, died suddenly two weeks before the association's meetings opened. He had completed his paper on "The Educational Opportunity" before his death and it was read to Section *J* by the president of the section.

The author stated that within the last year or two in Australia there had been an unprecedented interest in education. This had been effectively stimulated by the discovery of the atomic bomb, for education had become a means of self-protection. The fundamental problem of cooperation had to be tackled if the world was to continue to exist.

Interest so far had centred round the demand for better conditions for both pupils and teachers. Propaganda had certainly awakened the community to the fact that there was a big educational problem, but over-stress in bad conditions had perhaps given the impression that the teaching profession was something to be scorned and not entered. Yet the keystone to the educational situation was teacher supply. Unfortunately recruits were not coming forward. What were the considerations that kept men out of the teaching profession? They could perhaps be listed as follows: (i) The prevailing materialism of a community that had largely lost its sense of spiritual values. (ii) Neglect by the education departments of the unique opportunity for recruiting men and women from the services. (iii) The disinclination of bright and original minds to devote themselves to the teaching of conventional subjects to dull pupils. There was little conception of a school as an interested community to be developed and guided. (iv) Depressing effect upon ambitious young men of a fixed promotion system with seniority as its keynote. (v) Lack of recognition of the teaching profession by the community. Men would survive hard conditions, poor salaries, slow promotion—or the best of them would—provided they were given recognition. The teacher was often regarded as a man amongst boys and a boy amongst men.

What was the remedy for this? The teaching profession had to take matters into its own hands and become the architect of its own fortunes. The author suggested the establishment of a Royal Australian Guild of Teachers, somewhat similar to the Scottish Educational Institute established by Royal Charter in 1851. It should have as its members all qualified teachers in Australia, from both State and private schools, and should speak with authority in all matters affecting the profession itself, on ethics, etiquette, status of teachers and projected educational changes. It would vigorously oppose any attempt to make it into a glorified trades union. Each State and district might have its sectional branch. The guild should also be a common pool, from which qualified teachers might move, when necessity required, from State to State, and from church school to high school, or *vice versa*. The teaching profession would then be able to present an unbroken front to the community—the establishment of a high-grade professional organization such as that envisaged would be a serious step towards making the teaching profession distinguished and attractive. The world took institutions as it took people, very largely on their own estimate of themselves.

In regard to the pupils: Could advantage be taken of the existing opportunity to remedy a radical weakness in the Australian educational concept? Australia was anxious to develop good democratic citizens, but citizenship was still taught from books and the educational process had been sentimentalized to the extent of withdrawing from it any element of physical hardness. It should be remembered that a sense of adventure filled the whole being of the adolescent; his chief desire was to overcome situations and prove himself. He liked to feel his body tingling with fatigue—those delicious aches and pains—after a hard day's work.

Why not include in the secondary syllabus a first-class discovery, the forestry camp for schools? Through this it was possible to provide the practice of citizenship and the acceptance of testing situations. The movement had

originated in 1939 after the disastrous fires that devastated so many of the Victorian hardwood forests. At first the idea met with ridicule of the professional foresters, but they found that the boys cheerfully undertook and carried out the cutting up of fallen trees on the forest floor—work regarded by the foresters as "not a white man's job". When the firewood shortage occurred in 1942 the boys were called in again and cut thousands of tons of firewood.

Might not this be developed so that each secondary school would send its boys, in teams of fifty, to a forestry camp for three weeks in each year? Each camp would cost about £1,500 to build and £3,500 a year to maintain, but the work done by the boys would cover most of the expense. The Forests Commission in Victoria was very keen about the plan.

English experience along similar lines had been very successful. The boys developed physically, they gained a great deal of knowledge about afforestation, they developed a characteristic cooperative discipline of their own, and they were conscious that they were carrying out a man's job. A similar plan along suitable lines could easily be worked out for girls. Could any better offset to artificial unbiased conditions be imagined? He had mentioned two ways of using educational opportunity. Both repaired serious deficiencies. Neither was untried.

Soft Woods in Australian Forestry.

In his presidential address to Section *K*, G. J. Rodger, Director-General of the Commonwealth Forestry and Timber Bureau, said that Australia must make a definite effort to produce her own timber needs, particularly in soft woods. Present stands of soft woods were totally inadequate and were being rapidly exhausted. Native soft woods had not been supplying more than one-sixth of Australia's total requirements and the remaining stands were being rapidly exhausted. It was estimated that to meet the increasing demands for soft wood for Australia's growing population an intensely managed exotic soft wood forest estate of at least one million acres was needed. Present knowledge in Australia did not indicate more than five hundred acres suitable for this purpose.

The practice of forestry was an art which could be learnt only from experience, and in order to avoid mistakes, suitable foresters should be given the opportunity of obtaining practical experience in those forests of Europe where management had been evolved from centuries of practice.

The Pathological Approach to Problems of Animal Disease.

Dr. H. W. Bennetts (Perth), in his presidential address to Section *L* on the pathological approach to problems of animal disease, said that there was an urgent need for specialist study in veterinary pathology. During the past two decades bacteriological and parasitological contributions of outstanding merit had been made from the various laboratories throughout Australia, but, during the same period, there was little evidence of any corresponding interest in pathology. It seemed hardly credible that this was due to any lack of appreciation of the essential value of careful pathological studies for facilitating diagnosis and explaining the nature of obscure problems in animal health and nutrition. In order to emphasize the importance of a pathological approach, Dr. Bennetts reviewed the part played by pathological studies in the solution of a number of problems. The following conditions common to both Western Australia and South Australia were considered: Entero-toxæmia of sheep, diseases due to cobalt and copper deficiency or both (enzootic marasmus, ataxia of lambs and "falling disease" of cattle, coast disease), and finally a breeding problem of sheep on dominant subterranean clover pastures. The last was being investigated cooperatively in Western Australia by a team of workers under the general direction of an investigational committee comprising Dr. L. B. Bull, Mr. A. J. Vasey, Professor Underwood, Mr. F. L. Shier and Dr. Bennetts himself. The Australian Wool Board was providing financial assistance.

This breeding problem was characterized by three main manifestations: infertility, dystocia involving death of the full-term fœtus, and prolapse of the uterus. These together during the past six years had been responsible for very low lambings and considerable ewe wastage throughout much of the subterranean "clover belt" of Western Australia. Although the investigation was far from complete, comprehensive pathological studies had provided the key to an understanding of the real nature of the problem. There was very strong presumptive evidence that "affected" clover contained a potent œstrogen (female sex hormone) or œstrogen precursor. It was deduced that the various manifestations resulted from a corresponding imbalance of the normal hormonal control of the reproductive system.

Attempts to isolate the substance chemically had not yet been successful. Its presence in herbage was assayed by determining pathological changes induced in experimental animals. Experiments were proceeding designed to determine whether the potent factor was essentially characteristic of a particular strain or strains of clover or whether it was an abnormal constituent of plants grown under certain environmental conditions.

Survey of Botany in the Soviet Union.

In his presidential address to Section *M*, Professor E. Ashby (Sydney) said that all scientific research in Russia was under one or other of three government controls: the Academy of Science, the Ministry of Higher Education, or one or other of the industrial ministries. Botanical research was centred mainly in three institutes of the academy: the Institute of Botany in Leningrad, the Institute of Plant Physiology in Moscow, and the Institute of Genetics in Moscow; in a few universities and agricultural colleges; and in the Ministry of Agriculture. It was conducted on a very big scale. There were, for instance, 139 research stations concerned only with cereal crops, 17 with flax, 32 with potatoes, and so on.

In non-experimental botany the chief accomplishments were: (*a*) the "Flora of the U.S.S.R.", of which ten volumes had been published and fourteen more were to come; (*b*) the vegetation map of the U.S.S.R., made by a team of thirty men equipped with every means of transport from aeroplanes to ice-breakers and camels; and (*c*) the intensive studies of vegetation in deserts and the arctic.

Experimental botany for the most part followed traditional lines, and derived its inspiration mainly from the west. But there were some highly original researches on the control of flowering, on aging in plants, and on graft hybrids. Some of this work was based on the principles of dialectical materialism. At its best it was illustrated by the work of Krenke, who had devised methods for measuring "physiological age" as contrasted with "time age" in plants. At its worst it was illustrated by the work of Lysenko, whose technique was to discredit his opponents by innuendoes, and then to set up a "new genetics" based on unsound experiment and on appeal to authority reminiscent of mediæval obscurantism.

Classification in the Nervous System.

Professor R. Douglas Wright (Melbourne) in his presidential address to Section *N* discussed classification of the nervous system. He said that the nervous system played such an important part in the behaviour of all parts of the body that some grouping of knowledge by classification was a necessary aid to its organization. In the past the priority of anatomical study and clinical diagnosis had established anatomical classification as the dominant basis of this subdivision. With the increasing knowledge of the physiology of the nervous system it became evident that this anatomical method might hold back a fruitful field of functional correlations and should be reduced to the position of a motif in a larger functional design.

The first important branch of knowledge of the nervous system was that which dealt with the functional characteristics of the functional units of the nervous system: this dealt with the sensory, connector and motor neurones of the system.

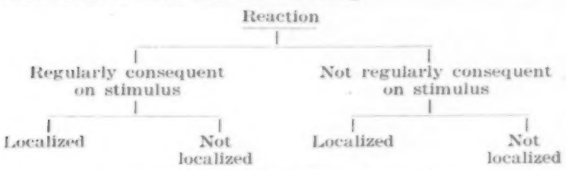
When one considered the whole nervous system it became apparent that Müller's law of specific energies could be used as a functional basis of classification. This law stated that sensory end organs were each most responsive to a particular form of energy change, for example, the retina to light, and if stimulated by any other means the sensation was one related to this energy. For example, if the retina was stimulated with a needle point there was no sensation of touch or pain, only of light.

Applying this law to the whole nervous system, one found that the energy changes to which the nervous tissues were sensitive were: (*a*) light; (*b*) heat and cold; (*c*) chemical changes—(i) gaseous, such as carbon dioxide, oxygen *et cetera*, (ii) non-gaseous, such as water, salt, sugar, fat, protein *et cetera*; (*d*) mechanical forces including sound.

At the normal levels these gave rise to discriminative perception; at excessive levels they gave rise to unpleasant or painful sensations.

Further consideration showed that the anatomical arrangement of the nervous system was determined by these groupings.

The next problem in classification concerned the reaction of the body to these specific energy changes. While reactions specific to each energy change were evident grouping in each could be made into the following:



It was in these groupings that the problem of reflex, conditioned reflex, emotion and volition arose.

The Effect of the Nutritional Plane upon the Reactions of Animals to Heat.

Miss Kathleen W. Robinson and Professor Douglas H. K. Lee (Brisbane), in a paper on the effect of the nutritional plane upon the reactions of animals to heat, pointed out that it was often desired to raise heavy or fat animals in hot climates, but conflicting ideas were held whether heavy feeding rendered them unsuitable for tropical and sub-tropical conditions.

Experiments had been carried out with white leghorn hens, Australorp hens, middle-white pigs and cross-bred border-Leicester-merino sheep, in which some animals of each kind were reared upon a high plane diet and some upon a low plane diet. Once a week each animal was exposed to a hot atmosphere for seven hours. Hot wet and hot dry climates were used in alternate weeks. The behaviour of the rectal temperature, pulse rate, respiratory rate and weight loss was measured.

It had been found that, in all animals studied, the reactions of the high plane animals to hot conditions were significantly higher than those of the low plane animals. This was much more pronounced under the hot dry conditions. When, after 69 weeks, the diets of the hens were reversed, the relative reactions of the two groups upon exposure to heat were reversed much more rapidly than the body weights.

In another series of experiments, animals had been fed successively upon different diets which were of equal caloric value, but contained proportions of protein varying from 5% to 28·5%. Hens, a dog, a sheep and a pig were used. After a week's feeding with a particular diet, the animals were exposed to a critically hot atmosphere for seven hours and the reactions were studied. In no case was any evidence obtained that a high proportion of protein had any significant effect upon the reactions of the animals to heat.

The authors concluded that the caloric value of the current diet had a significant, and at times practically important, effect upon the reactions of animals to hot conditions; but the proportion of protein contained in the diet was of no significant moment.

The Action of Insulin and Anterior Pituitary Hormones in Relation to Carbohydrate Metabolism.

Dr. A. B. Corkill and J. F. Nelson (Melbourne) reported experimental studies on the action of insulin and anterior pituitary hormones in relation to carbohydrate metabolism. They said that diabetes in man might be divided into two main types, (*a*) the insulin sensitive and (*b*) the insulin resistant. In the latter it was probable that the diabetic state was due to other hormones interfering with the action of insulin. There was considerable evidence that the diabetogenic hormone of the anterior pituitary gland might be implicated. Experimentally, animals might be made resistant to the hypoglycæmic action of insulin by injections of suitable extracts of the anterior pituitary gland; with intensive treatment a true diabetic state might be produced. In earlier studies with the diaphragm muscle of the rat obtained from animals previously injected with anterior pituitary extract, it had been shown that insulin was less effective in laying down glycogen. This would suggest that the pituitary-insulin antagonism was exerted in the peripheral tissues. In recent experiments Cori had studied hexokinase activity in muscle extracts prepared from rats which had been injected with anterior pituitary extract. Hexokinase activity was inhibited. The authors had extended these results to their own findings, and it had been shown that in the isolated rats' diaphragm obtained from animals treated with anterior pituitary extract there was probably a slowing down in the phosphorylation of glucose. It was of interest to note that in the above preparation insulin caused no increase in oxygen consumption. These facts were discussed in detail in relation to insulin and anterior pituitary antagonisms.

Some Aspects of Carbohydrate Metabolism in the Ruminant.

I. G. Jarrett (Adelaide), in a paper on some aspects of carbohydrate metabolism in the ruminant, said that the ruminants were characterized by possessing a complex stomach, and it was in the sheep, ox and goat that this attained its highest degree of complexity. The nutrition of the ruminant had certain peculiarities and these were in all probability associated with the structural differences encountered between these animals and non-ruminants. It was in the rumen or forestomach that the cellulose and related carbohydrates of the diet underwent a fermentation by free microorganisms before ultimate digestion could take place. The products of this fermentation were mainly carbon dioxide, methane and the volatile fatty acids, acetic, propionic and butyric, and it had been shown that absorption of these fatty acids took place from the rumen. If, as had been suggested, the ruminant derived most of its energy requirements from these lower fatty acids, then sugar might assume a role of subsidiary importance in the intermediary metabolism of these animals. The concentration of glucose in the blood of normal sheep and goats was approximately half that of man and other animals. This low concentration was not appreciably diminished after several days of fasting, and massive doses of insulin were needed to lower it materially below the normal level of between forty and fifty milligrammes per hundred millilitres. This normal low blood sugar concentration could not be explained by an unusually efficient utilization of sugar or by a low renal threshold. As part of a general study of carbohydrate and fat metabolism of sheep an animal with typical diabetes was required—a condition never previously reported for this animal. This had now been successfully achieved by means of intravenous injection of alloxan. Blood sugar values of 200 to 300 milligrammes per hundred millilitres had been obtained with urinary excretion of about 60 grammes of sugar and 12 grammes of ketone bodies each day. The diabetic syndrome could be controlled with insulin injections. Thus, although the intermediary metabolism of sheep might proceed through channels that differed from non-ruminants, the disordered metabolism typical of diabetes could be produced. If it was assumed that the lower fatty acids, acetic, propionic and butyric, were the major source of energy, the problem of sugar and insulin became rather complex. The importance of acetic acid became prominent when one considered the possible production of ketones by this substance. Although the ketogenic effect of acetic acid had been established for other animals, the authors had not been able to demonstrate ketone production following administration of 200 grammes of sodium acetate per day for three weeks. Recent work with phlorhizinized sheep had shown a glucogenic effect of acetic acid in this animal. When 30 grammes of acetic acid neutralized to pH 7·2 with sodium hydroxide were injected into the peritoneal cavity, it appeared possible for up to 25% to 30% to be converted to sugar. The problem then became one of intermediary metabolism with the stress upon the interrelation of fat and carbohydrate. Recent work with the tricarboxylic acid cycle suggested possible pathways whereby the conversion of fat to carbohydrate might take place and acetic acid might assume a prominent role. It was felt that the sheep was an ideal physiological tool for further studies in this field.

The Production of Amino Acids by Bacteria Adapted to Sulphathiazole.

J. P. Callaghan (Sydney) read a paper on the production of aromatic amino acids by bacteria adapted to sulphathiazole. He said that Woods had first shown that *p*-aminobenzoic acid was capable of reversing the action of sulphonamides on bacteria, and he and Fildes had developed the most generally accepted theory of sulphonamide action, which bore their names. It was assumed that *p*-aminobenzoic acid was an essential metabolite for microorganisms, and that the enzyme system of which it was the substrate was inhibited by the competition for the active centres of the enzyme by the sulphonamide. The central point of the theory was that inhibition was brought about by structural analogues of the substrate.

It had been suggested that drug-fastness in bacteria was due to the production by such adapted organisms of sufficient *p*-aminobenzoic acid to overcome the action of the sulphonamide. Attempts made by other workers to show increased production of this substance had not been

conclusive, because the acid was detected either by unspecific chemical reactions (Bratton and Marshall reaction) or by microbiological assay, which was of doubtful specificity. Rubbo and Gillespie had succeeded in isolating *p*-aminobenzoic acid from yeast, but no similar isolation had been reported for sulphonamide-resistant organisms.

Lemberg and Callaghan had developed methods of considerable specificity for separating aromatic amino acids from culture media. These depended on a combination of the diazotization and coupling reactions with chromatography of the resulting dyes.

It had thus been shown that *Bacillus coli* adapted to sulphonamide produced no more *p*-aminobenzoic acid than unadapted organisms, and that the sulphonamide fastness could not be attributed to the *p*-aminobenzoic acid synthesized by the organism. Of the aromatic amino acids produced, *p*-aminobenzoic acid formed the smallest portion, anthranilic acid the next, and a third substance was frequently present in considerable amount. There was some evidence to suggest that under the conditions of the experiment the dye was derived by an abnormal coupling reaction from anthranilic acid. No other diazotizable amino acids were detected.

This work demonstrated clearly the danger of determining *p*-aminobenzoic acid in biological fluids by means of the Bratton and Marshall test. Grossly erroneous results might be obtained unless it could be shown that no arylamine other than *p*-aminobenzoic acid was present.

The results did not affect the applicability of the Woods-Fildes theory; they necessitated, however, the search for a different explanation of drug-fastness from that already mentioned. Such an explanation would be the substitution of a different enzyme system for that of which *p*-aminobenzoic acid was the substrate, when the latter system was blocked by sulphonamide.

One important observation made in the course of this work was the great variability of the metabolism of *Bacillus coli* over a period of time. There was no relationship demonstrable between the amount of sulphonamide to which the organism was resistant and the arylamine production, the latter fluctuating greatly in the course of weeks or months. This in itself rendered any connexion between the two phenomena unlikely.

The biochemical work reported had been carried out by Dr. Lemberg and Dr. Callaghan. Dr. Goldsworthy and Dr. Tandy had been responsible for the bacteriological side of the investigation, including the development of sulphonamide-resistant cultures and their maintenance over long periods.

The Biochemistry of Prothrombin.

Dr. P. Fantl and M. Nance (Melbourne) described studies on the adsorptive power of various colloidal suspensions towards prothrombin. A great variety of substances such as tertiary calcium phosphate, various forms of colloidal aluminium hydroxide, magnesium hydroxide and barium sulphate had been examined.

The adsorbates had been analysed for total nitrogen concentration. Since the protein concentration in the adsorbates varied greatly and was higher than expected, it appeared that these substances did not absorb prothrombin only. Barium sulphate and more especially barium carbonate had been found suitable for removing prothrombin preferentially to other plasma proteins. In a series of specimens of normal human plasma it had been found that 1·7 to 2·5 milligrammes of protein nitrogen per hundred millilitres of oxalated plasma were removed with the prothrombin fraction. All the nitrogen was present as protein.

In experiments in which a fractional adsorption of prothrombin with increasing amounts of barium carbonate was carried out, plasma containing varying amounts of prothrombin could be prepared, and the results of protein estimations on the adsorbates agreed with the expected percentage reduction of prothrombin as shown by the clotting time of the treated plasma. In this way it appeared to be possible to correlate actual amounts of prothrombin estimated by a chemical method, with the estimation by clotting time. Evidence was produced to show that barium carbonate did not destroy prothrombin and was probably inert to other plasma constituents.

It was possible to elute prothrombin from the adsorbed state, and the isolated compound was assayed with various thromboplastins and purified fibrinogen preparations. Such a system was active as far as clotting power was concerned, and thus would negativate the assumptions of Quick and Nolf, who had postulated a more complex structure for prothrombin. It had been observed, however, that the reaction rate of this synthetic system was rather slow. Maximum activity was attained after a preliminary incubation period of approximately an hour. If on the other hand the isolated prothrombin was added to prothrombin-free plasma, thrombin formation proceeded at a much greater speed. It was concluded from these experiments that prothrombin isolated from human plasma was the only precursor of thrombin, but that normal plasma contained in addition to prothrombin an accelerator of thrombin formation. This accelerator had been prepared from oxalated plasma in a mixture with fibrinogen. If such preparations were tested on isolated prothrombin, maximum activity was obtained without preliminary incubation.

Tropical Fatigue and Warfare.

Professor Douglas H. K. Lee and R. K. Macpherson (Brisbane) discussed the question of tropical fatigue and warfare. They pointed out that with the control of infective agencies such as malaria, the effect of climatic factors upon the efficiency and health of combatant forces in the tropics had become a matter for closer investigation. The conduct of military operations in the South-West Pacific Area had provided both the opportunity and the necessity for an investigation of the nature, incidence and control of "tropical fatigue".

In a field survey under joint arrangements by the Australian Military Forces and the Royal Australian Air Force, a systematic study was made of 1,507 ground-crew members of the Air Force serving in the combat zone, and of 250 ground-crew members stationed in southern Queensland. Records had been made in each case of relevant factors such as preembarkation service; length of tropical service; mustering; incentives; subjective and objective estimates of efficiency; nature, intensity and duration of work; medical history. Measurements had been made and recorded of objective indices such as stance, gait and dress; height and weight; circulatory reactions to tilting; rate of sweat loss and evaporation; the result of the Harvard pack test and of the subacute exercise test. Correlation of objective indices with length of tropical service and other items had been sought statistically and, where they were significant, regressions determined.

Subsidiary investigations had been made of weight loss, skin disease, surface brightness, and the effect of jungle patrols.

The main facts emerging from a statistical analysis of the data obtained were as follows:

1. The Harvard pack test index in tropical personnel showed the following associations: (*a*) a reduction of 0·06 unit per week of previous tropical exposure; (*b*) a reduction of 0·18 unit per week of tropical service; (*c*) a rise with the intensity of the mental work customarily performed; (*d*) a close association with the subject's own estimate of his efficiency; (*e*) a significant reduction in the driver-dispatch rider group.

2. Only a slight increase in vasomotor instability was discernible in tropical personnel. Pulse rates and blood pressures were relatively unaffected.

3. While tropical personnel showed slight losses of weight as compared with controls, there was no evidence that this was progressive.

4. Fifty-seven *per centum* of personnel (average tropical service 31·7 weeks) had contracted some skin disease, although usually of mild or moderate degree.

5. As against the relatively slight objective findings, there was no doubt that reduced efficiency was widespread in the Royal Australian Air Force ground crews. This was revealed by officers' replies to questions, lowered subjective estimates of efficiency, undue complaint by the men of minor affections and increased attendance for medical attention.

While climatic effects *per se* could be cited as the major cause of skin affections, and a contributory cause of general inefficiency, the observers had been led to the conclusion that personal and psychological factors were of paramount importance, and that much of the inefficiency was preventible by realistic handling of these factors.

The Theory of Function of Respiratory Enzymes.

Dr. R. Lemberg (Sydney) discussed new aspects of the theory of function of respiratory enzymes. He said that respiratory enzymes were defined as cell catalysts which transferred hydrogen (or electrons) from a donor molecule to oxygen or hydrogen peroxide. This view was of general applicability if in the case of the cytochrome system the cytochrome oxidase-cytochrome c complex (Stotz, Altschul

and Hogness) was considered as a unit, and if in the case of catalase, hydrogen peroxide was assumed to act as a hydrogen acceptor as well as a hydrogen donor.

Chemically the respiratory enzymes were hæmoproteins which owed their high catalytic activity to combinations of hæmatin with specific proteins in a specific manner. Hæmatin and its simpler compounds had some of the properties essential for the catalytic action of the enzymes (combination with oxygen and hydrogen peroxide) in a rudimentary way; they also reacted with the specific enzyme inhibitors, such as carbon monoxide and cyanide. They were, however, much weaker catalysts, and qualitative differences between enzymes and hæmatin could also be pointed out.

The protein not only provided the anchoring ground for the hydrogen donor, it also profoundly influenced the properties of the hæmatin iron. It made it able to combine with oxygen to a stable ferrous compound in hæmoglobin and to an unstable one in the respiratory ferment, or to combine with hydrogen peroxide to a rather stable compound in peroxidase and to a very unstable one in catalase. Combination of hæmatin with protein *per se* did not increase the catalytic activity; hæmoglobin was a poor oxidase, catalase or peroxidase; normally catalase was peroxidatively inactive and peroxidase catalatically inactive.

Previous theories of the function of respiratory enzymes had not paid sufficient attention to this specificity, for example, the radical chain theory. This should also be rejected for the reason that the assumption of reactive free radicals contradicted the biological principles of regulated control. In physiological reactions reactive radicals were avoided, partly by resonance stabilization, and more importantly by the occurrence of reactions inside a complex, such as oxygen-cytochrome oxidase-cytochrome c hydrogen donor or hydrogen peroxide-peroxidase-hydrogen donor (Michaelis, Szent Györgyi).

The following factors were of importance for the explanation of the protein specificity: (*a*) stereochemical configuration of the protein and type of linkage between protein and hæmatin; (*b*) stabilization of the valency of the hæmatin iron (ferrous, ferric); (*c*) appropriate spots of combination for the hydrogen donor in the protein part of the enzyme molecule; (*d*) the presence, in appropriate positions of the protein part of the enzyme molecule, of hydrogen donor or acceptor groups which took part in the reaction as intracomplex carriers. The last aspect had so far received no attention, and Dr. Lemberg therefore discussed it more fully.

On this basis a theory of the function of respiratory enzymes was developed which, while explaining the specificity of the enzymes, also led to an understanding of changes in catalytic behaviour which could be noticed under certain conditions. Under special conditions catalase could act as peroxidase ("coupled oxidation of alcohol", autodestruction, anticatalase action), peroxidase as oxidase (dihydroxymaleic acid oxidase) or catalase (hydrogen peroxide excess). Oxidative and peroxidative reactions of hæmoglobin were of no significance for its physiological purpose, but were of great interest with regard to its oxidation to methæmoglobin and its physiological breakdown to bile pigment. In the autoxidation of hæmoglobin and in the activation of the oxygen of oxyhæmoglobin by acidification or denaturation hydrogen donor groups of the globin could be shown to enter the reaction. On this basis a theory of the processes occurring in the oxygen-cytochrome oxidase-cytochrome c complex was developed.

By experiments on the azide inhibition of catalase it was shown that Keilin's theory of catalase function was incorrect. A new theory was developed in which it was assumed that a specific group in the protein part of the catalase molecule accepted the hydrogen from hydrogen peroxide in the hydrogen peroxide catalase complex; it was assumed that in this case the hydrogen peroxide bound to the hæmatin iron acted as hydrogen donor, that bound to the protein or reacting with the protein as hydrogen acceptor.

Dr. Lemberg held that the abnormal reactions enumerated could be understood if, in addition to valency changes of the hæmatin iron, changes of the hydrogen donor and acceptor groups in the protein part of the enzyme molecule were postulated. He drew attention to the heuristic value of this hypothesis.

The Uric Acid Content of the Integument.

Dr. A. Bolliger (Sydney) read a paper dealing with the uric acid content of the integument. He said that uricotelic metabolism with uric acid as principle and product occurred in birds, snakes and lizards, and it had been known for some time that the shed skin of the snakes contained considerable amounts of uric acid. Recently it was observed by Dr. Bolliger that the feathers of birds contained ten to twenty times as much uric acid as did their blood. In a number of birds it was found that a considerable amount of the urate occurring in the plumage could be readily removed by cold water. This indicated a possible route of excretion additional to the renal passage.

Somewhat unexpected were the findings in mammals which, with the exception of primates and the Dalmatian coach hound, were ureotelic in their nitrogen metabolism. Generally speaking, all mammals examined were found to contain uric acid in the keratinous appendages of their skin in excess of the amount present in the blood. Those mammals with a low uricolytic index such as man, chimpanzee and Dalmatian coach hound, had a low uric acid content in their hair. In addition, all other breeds of dogs had a high uricolytic index and the hair of those examined contained about ten times as much uric acid as that of the Dalmatian. Values as high as 500 milligrammes *per centum* were encountered in the hair of the rabbit, and in the majority of mammals tested so far the urate content exceeded 100 milligrammes *per centum*. The ungulates, on the other hand, were characterized by values below 100 milligrammes *per centum*.

Uric acid was also found to occur in other types of keratinous appendages of the skin such as horns, hoofs, claws and quills, and from the constant occurrence of urates in all types of keratinous integument it was concluded that uric acid was a constituent of the protein keratin. On the other hand, it was removed with remarkable ease by hot water from these mammalian keratinous appendages.

The uric acid content of hairs frequently varied with their position on the body, being sometimes much greater on the dorsum than on the abdominal surface or *vice versa*. In normal human beings such differences had also been encountered and pubic hair was frequently found to have a higher uric acid content than head hairs. In cases of renal insufficiency markedly increased uric acid content of the pubic hairs had been encountered.

Chemical Structure and Enzyme Specificity.

Dr. Alfred Gottschalk (Melbourne) read a paper on some aspects of the relationship between chemical structure and enzyme specificity. He said that when a single enzyme was capable of acting on several substrates, their molecular structures exhibited a common pattern which might comprise a larger or a smaller portion of the substrate molecules concerned. In the case of yeast hexokinase the molecular structure of its substrates could not be identified by experiments at 25° C. or higher temperatures for the following reason: On solution in water, the crystalline hexoses exhibited mutarotation which mainly consisted in a reversible interconversion of the α and β and of the pyranose and furanose modifications of the individual hexose. At room temperature equilibrium between these various modifications of a hexose was quickly established. At 0° C. and pH 4·5, however, mutarotation proceeded very slowly, so that for an interval of twenty to thirty minutes one well-defined sugar modification only was present. Fermentation experiments carried out at 0° C. had revealed that of the various hexoses α and β glucopyranose and β fructofuranose were readily consumed by the living yeast. Mannose, either in the α or β pyranose form, and fructopyranose were not appreciably fermented under these conditions. Fructopyranose was unfermentable owing to the lack of an esterifiable –OH group at carbon atom six; d-mannose was unfermentable at 0° C. because, as was shown by experiments with dried yeast, it was unable to penetrate the cell membrane at 0° C. within the limited time.

Dr. Gottschalk discussed the atomic grouping common to the fermentable hexose modifications and suggested that the active groups of the hexokinase protein most probably made contact with the hydroxyl groups attached to carbon atoms 3 and 4 of the fermentable hexose.

The Synthesis of Porphyrins and Hæmoglobin in the Animal Body.

Dr. R. Lemberg (Sydney) discussed the synthesis of porphyrins and hæmoglobin in the animal body. He said that a satisfactory theory of the porphyrin synthesis in the animal body must account for the following facts: The predominant synthesis of protoporphyrin IX which became incorporated in the hæmoglobin molecule, the formation of small amounts of coproporhyrins I and III, the absence of other isomerides, and the formation of uroporphyrins I and III in porphyria.

The theories of Rimington and Dobriner, who, like most other workers, assumed an ascending carboxylation, failed to give a satisfactory explanation of these facts. Turner had first assumed progressive decarboxylation of porphyrins or their precursors, but in other regards his theory was equally unsatisfactory.

The facts known on the synthesis of porphyrin in yeast and on the incorporation of labelled carbon and nitrogen indicated that porphyrins were synthesized from products of carbohydrate metabolism and ammonia or glycine. It was shown that the formation of pyrrole or pyrrolidone precursors, of the nature required for the synthesis of uroporphyrin (with acetic and propionic acid side chains), was easily conceivable as due to condensation of ketoacids, such as α-ketoglutaric or succinylacetic acid, with ammonia or glycine. In fact such a pyrrolidone compound had been isolated in 1931 from the liver by Dakin and West.

Such syntheses led to pyrroles which in addition to the side chains in the β-positions had also one of the α-positions substituted by a carbon atom, which later provided some of the methene bridges of the porphyrin. The importance of this for the theory of porphyrin synthesis was pointed out. It explained why only two types of dipyrrolic compounds (type abab, mono-substituted in α) and type abba (disubstituted in α) could be formed, the former by autocondensation, the latter by condensation with formaldehyde or formic acid, and also why only types I and III of porphyrins arose.

It was assumed that the acetic acid groups, very labile *in vitro*, were normally decarboxylated to methyl (uroprecursors → copro-precursors), and that only one of the two dipyrrolic precursors with methyl and propionic acid side chains (type abab) underwent oxidative decarboxylation, which transformed the propionic acid side chains to vinyl groups. In this way the formation of protoporphyrin IX with small amounts of coproporphyrins I and III and the lack of other isomerides could be explained. The synthesis of the protoporphyrin and the incorporation of iron in the hæmoglobin molecule probably proceeded "in the lap" of the globulin.

This theory required fewer unproved hypothetical assumptions than any of the previous theories. Dr. Lemberg discussed its significance for the understanding of porphyrin formation in diseases.

Some Reversible Actions of the Blood Pigment and their Relation to the Formation of Green Derivatives.

H. F. Holden (Melbourne) in a paper on reversible reactions of the blood pigment said that a number of reagents that denatured (irreversibly) oxyhæmoglobin could convert hæmoglobin into substances whose spectra resembled that of denatured globin hæmochromogen. On the lowering of the concentration of the reagents these substances reverted to hæmoglobin. Some of the same class of reagents were among those most active in promoting the formation from hæmoglobin of green pigments with absorption bands in the red region of the spectrum when in their presence oxyhæmoglobin was treated concurrently with sodium hyposulphite and oxygen. This class of reagents included sodium benzoate, sodium salicylate, sodium benzene sulphonate, potassium iodide and ethanol. Other reagents which in low concentration promoted the formation of such green pigments had a direct denaturant action on hæmoglobin in higher concentration. Such were pyridine, phenol, formaldehyde and ammonium thiocyanate.

The Aural Effects of Blast.

Dr. G. Reid (Sydney) discussed the aural effects of blast. He said that artillerymen had been audiometrically examined before and after exposure to gun blast, the blast pressure curves being recorded with a Piezo gauge and cathode ray oscillograph. Peak pressures ranged from 0·25 to 8·0 pounds per square inch. Medical students had been exposed in the laboratory to a peak pressure of three to four pounds per square inch.

The results showed considerable individual variation in susceptibility. With successive rounds the loss of hearing increased until further rounds had little or no effect. The order in which deafness developed with respect to frequency and the final shape of the audiogram depended on a "pattern of damage" peculiar to the individual, but in general, deafness affected mainly the upper range (extending as low as 256 cycles per second). This deafness was of cochlear or nerve origin.

Loss of hearing lasted from several hours up to several days, recovery following roughly an exponential curve with respect to time.

Other things being equal, the degree of hearing loss depended mainly on the peak positive pressure. Rupture of the eardrum occurred in one subject exposed to a pressure of six to eight pounds per square inch.

Cotton wool plugs were an inadequate form of ear protection.

Audiometric examination of artillerymen showed that of 116 men without evidence of middle ear involvement, 50% had peak losses in the worse ear greater than 30 decibels. The mean average hearing loss of the group was 10·2 decibels. The corresponding figure for a group of 103 medical students was 0·52 decibel. This difference was highly significant. All the types of audiogram met with in the study of permanent deafness were observed during the study of temporary deafness.

Dr. Reid also discussed the relationship of temporary and permanent deafness to trauma.

The Separation of Thrombin into Two Components.

R. N. Lyons (Sydney) said that in the clotting of fibrinogen by thrombin an intermediate between fibrinogen and fibrin was formed which differed from native fibrinogen A in that it possessed free –SH groups. Substances, particularly quinones, which oxidized –SH groups would convert this altered fibrinogen to a fibrin gel. After reacting with fibrinogen A, purified thrombin could be separated into two components by adsorption technique. One component would convert fibrinogen A to the intermediate –SH form, the other component would clot this intermediate. Neither component alone would clot fibrinogen A, but a mixture of the two did so readily. Since pure thrombin could not be separated into components, nor would it clot the intermediate –SH form until it had reacted with fibrinogen A, Mr. Lyons suggested that thrombin was a unit which was divided into at least two components when reacting with fibrinogen A.

Scientific Institutes.

The Waite Agricultural Institute was visited by over 600 delegates to the congress. Exhibits of the work of the departments of agronomy, agricultural chemistry, entomology, plant pathology and plant physiology were shown and visitors were able to view the garden at "Urrbræ House" as well as the glasshouses, experimental fields, meteorological instruments, grass garden and arboretum.

The members of Section *N* made a tour of inspection of the department of human physiology and pharmacology in the University of Adelaide, and an inspection of the Institute of Medical and Veterinary Science was made by Sections *I*, *L* and *N*.

Excursions.

A pleasant feature of the congress was the number and variety of excursions planned by the South Australian Committee. The Australian Chemical Institute arranged an excursion for Section *B* to the Tartrate Recovery Works at Tarac Limited, Nuriootpa, and Yalumba Winery, Angaston. Excursions to Hallett's Cove, Mount Lofty and Victor Harbour were made by Sections *C*, *E* and *P*. The members of Section *G* (economics, statistics and social science) visited the community centre at Nuriootpa.

Members of the Section of Anthropology visited the Mount Pleasant district where camp sites and native paintings in Eden Valley were examined, and also made a tour of the Burra and Deep Creek to examine the intagliated carvings made by aborigines on flat stones in the bed of the creek.

For the members of Section *K* (agriculture and forestry) excursions to Roseworthy Agricultural College and Mount Crawford Forest were arranged, and at the end of the congress a party of twenty left for the south-east, to visit Mount Gambier, Millicent and the Ninety-mile Desert and to see the work being done in countering mineral deficiencies in pastures and forests. Sections *M* and *P* visited Mannum, via Aldgate and Woodside, returning by Torrens Gorge.

After the congress a party left for Port Pirie and Whyalla, and another party of seventeen made a tour of the Flinders Ranges. A group of about twenty geologists and anthropologists went to Mount Painter, and another party of scientists went to Alice Springs.

Conclusion.

This meeting of the association was the first held since 1939, as it had been impracticable to arrange general meetings during the war years. Reviewing the work of the congress, Dr. A. B. Walkom said that the difficulties of calling so many scientists together so soon after the war had been very considerable because of the shortage of

transport and accommodation. The results, however, had more than justified the summoning of the congress. Over 1,500 members attended the congress, and of these, nearly 700 came from States other than South Australia and from New Zealand. This was almost double the number that had been expected. Dr. Walkom paid a tribute to the hospitality of the Government and the people of South Australia.

British Medical Association News.

NOTICE.

A MEETING of the Section of Neurology and Psychiatry of the Victorian Branch of the British Medical Association will be held at the Medical Society Hall, Albert Street, East Melbourne, on Thursday, October 24, 1946, at 8.15 p.m. All members desirous of joining this section are urged to attend. Following the election of office-bearers there will be a symposium on "Pre-frontal Leucotomy"; the introductory speakers will be Dr. R. S. Hooper, Dr. D. F. Buckle and Dr. J. Hurt. Visitors will be welcome.

Correspondence.

PAIN IN AN AMPUTATION STUMP ASSOCIATED WITH SPINAL ANÆSTHESIA.

SIR: The following case seems to me to be of sufficient interest to warrant publication.

E.G.M., aged fifty-one years, married, a railway clerk, had most of his right leg amputated in March, 1917, in France for a gunshot wound two days after being wounded. The stump was healed in three months. He has been wearing an artificial limb since December, 1917. He had painful nerve bulbs removed on five occasions up to 1935. He occasionally gets attacks of pain in the stump at about yearly intervals, chiefly at night, and lasting for four to ten hours. He has had relief from heat and aspirin. His prosthesis is an end-bearing one, on a three-inch tibial stump, and he can walk four to five miles in comfort.

He came to me in May this year complaining of a right inguinal hernia of recent origin. Inguinal herniorrhaphy was performed on May 21. Premedication with a hypodermic injection of one-quarter of a grain of morphine and 1/100 of a grain of hyoscin was used. Spinal anæstheesia was induced with 1·8 millilitres of hyperbaric "Percaine" solution; half a grain of ephedrine was given subcutaneously. There was no difficulty in giving the spinal injection.

As soon as the anæsthesia took effect the patient began to experience severe pain in the amputation stump. It was so severe that he cried out in agony and was not relieved by another one quarter grain of morphine. He described the pain afterwards as being as though someone was kicking the nerve endings. The pain did not abate till the anæsthetic wore off, when it went entirely. The herniorrhaphy was by another quarter-grain of morphine. He described the explanation to others.

Yours, etc.,

Undated. BROOKE MOORE.

Naval, Military and Air Force.

APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Number 187, of October 3, 1946.

CITIZEN NAVAL FORCES OF THE COMMONWEALTH.

Royal Australian Naval Reserve.

The appointments of the following officers have been terminated on the dates stated: Surgeon Lieutenant-Commander Samuel Edward Lees Stening, D.S.C., 5th December, 1945; Acting Surgeon Lieutenant-Commander John Francis Rutter, 25th June, 1946; Surgeon Lieutenant Peter Orlebar Bishop, 25th June, 1946; Surgeon Lieutenant Shane Andrew Clarke Watson, D.S.C., 7th July, 1946; Surgeon Lieutenant Ronald George Macalpine McKay, 8th July, 1946.

ROYAL AUSTRALIAN AIR FORCE.

Citizen Air Force: Medical Branch.

The probationary appointments of the following Flight-Lieutenants are confirmed with effect from the dates indicated: L. G. Knott (277475), 6th February, 1945, E. R. W. Thomson (277232), W. L. Morris (267522), R. A. Godfrey-Smith (257579), C. Lancaster (257597), J. H. A. Floyd (257657), J. J. Nattrass (257665), V. T. Stephen (257670), A. H. Toyne (267719), A. M. Beech (257693), C. H. Walsh 267801), L. J. Wienholt (277543), 17th December, 1945, I. H. Ogilvy (257507), T. Early (297427), J. E. Joseph (257661), G. C. Morrison (257664), P. M. Birrell (297470), A. C. Newell (257690), J. V. Vaughan (257698), P. H. Cohen (257700), L. L. Lewis (267760), H. P. Greenberg (267761), G. A. Leyland (287460), D. L. Rodgers-Wilson (257702), M. Cohen (297484), 22nd January, 1946, W. G. MacGregor (257506), K. H. Pike (277438), A. S. Feddersen (257692), P. J. White (257696), J. L. Fordyce (257695), R. W. M. Gray (267762), T. J. Thwaite (267766), P. Grattan-Smith (267785), R. K. Smith (257715), W. M. Calanchini (257721), C. I. Wilkinson (277479), 26th February, 1946.—(Ex. Min. No. 231—Approved 2nd October, 1946.)

Flight Lieutenant L. G. Knott (277475) is called up for service with the Active Force for full-time duties with effect from 6th August, 1944.

The appointments of the following officers are terminated on demobilization with effect from 9th August, 1946: (Temporary Squadron Leaders) H. C. Stone (251560), 7th August, 1946, J. R. F. England (283727), 8th August, 1946, Flight Lieutenant, Acting Squadron Leader D. F. Buckle (263865), 12th August, 1946, Flight Lieutenant A. D. Packer (287403), 5th August, 1946.

The appointments of the following officers are terminated on demobilization with effect from the dates indicated: (Temporary Flight Lieutenants) B. S. Skerman (277459), 2nd August, 1946, C. R. Dines (277458), J. G. Opie (266846), 13th August, 1946.—(Ex. Min. No. 236—Approved 2nd October, 1946.)

The appointment of Flight Lieutenant A. C. Schwieger (257345) is terminated on demobilization with effect from 5th August, 1946.

Post-Graduate Work.

THE POST-GRADUATE COMMITTEE IN MEDICINE IN THE UNIVERSITY OF SYDNEY.

WEEK-END COURSE AT WOLLONGONG.

THE Post-Graduate Committee in Medicine in the University of Sydney announces that a week-end course will be held at Wollongong on Saturday and Sunday, November 2 and 3, 1946, in conjunction with the South-Eastern Medical Association.

The programme of the course will be as follows:

Saturday, November 2, 1946.

At the Wollongong District Hospital.

2 p.m.: Registration.
2.30 p.m.: "The Management of Acute Intestinal Obstruction", Dr. K. W. Starr.
4 p.m.: "Can We Make Breech Presentation Easier and Safer?", Professor Bruce T. Mayes.

Sunday, November 3, 1946.

At the Wollongong District Hospital.

10 a.m.: "Traumatic Surgery of the Hand", Dr. K. W. Starr.
11.30 a.m.: "Modern Views on Nephritis", Dr. C. G. McDonald.
2 p.m.: "Recent Advances in the Treatment of Sterility", Professor Bruce T. Mayes.
3 p.m.: "Atheroma and Essential Hypertension from the Clinical Point of View", Dr. C. G. McDonald.

The fee for the course will be £1 1s., except for members of the defence forces, who may attend without fee. Those intending to be present are requested to notify Dr. R. A. Green, Honorary Secretary, Clinical Society of the South-Eastern Medical Association, Port Kembla, as soon as possible.

COURSE FOR THE PRIMARY F.R.C.S. EXAMINATION.

The Post-Graduate Committee in Medicine in the University of Sydney will be conducting a course of lectures

in applied physiology and the principles of pathology suitable for candidates for the primary examination of the Fellowship of the Royal College of Surgeons of England, beginning shortly. Candidates for this course are requested to make early application to the course secretary of the committee, 131, Macquarie Street, Sydney, from whom full details may be obtained.

Nominations and Elections.

THE undermentioned has applied for election as a member of the New South Wales Branch of the British Medical Association:

Hart, Henry Ellard, M.B., B.S., 1944 (Univ. Sydney), 139, Arden Street, Coogee.

The undermentioned have been elected as members of the New South Wales Branch of the British Medical Association:

Conacher, Dorothy Wolseley, M.B., B.S., 1945 (Univ. Sydney), Rutledge Street, Eastwood.

Conneely, Thomas Gerard, M.B., B.S., 1941 (Univ. Sydney), Hastings Hotel, Wauchope.

Downie, David Alfred William, provisional registration, 1946 (Univ. Sydney), Wallsend District Hospital, Wallsend.

Murray-Prior, Hugh Burnett, M.B., B.S., 1942 (Univ. Sydney), (Captain), 120th Australian Special Hospital, Little Bay.

Richardson, Stephen, provisional registration, 1946 (Univ. Sydney), Balmain and District Hospital, Balmain.

The undermentioned were elected members of the South Australian Branch of the British Medical Association:

Haselgrove, Harold Frederick, M.B., B.S., 1946 (Univ. Adelaide), 33, Stepney Street, St. Peters.

Sibthorpe, Gwenyth, M.B., B.S., 1946 (Univ. Adelaide), 30, Main Street, Henley Beach.

Obituary.

AUGUSTUS LEO KENNY.

WE regret to announce the death of Dr. Augustus Leo Kenny, which occurred on September 27, 1946, at Melbourne.

EDWARD DAUNT BYRNE.

WE regret to announce the death of Dr. Edward Daunt Byrne, which occurred on September 30, 1946, at Melbourne.

WILLIAM EDWARD HARRISON.

WE regret to announce the death of Dr. William Edward Harrison, which occurred on October 3, 1946, at Bendigo, Victoria.

SYDNEY NORMAN RORKE.

WE regret to announce the death of Dr. Sydney Norman Rorke, which occured on October 12, 1946, at Kingsford, New South Wales.

Books Received.

"Practical Chemistry for Medical Students", by William Klyne, M.A., B.Sc. (Oxon.), with a foreword by G. F. Marrian, D.Sc. (London), F.R.S.; 1946. Edinburgh: E. and S. Livingstone Limited. 8½" × 5½", pp. 476, with illustrations. Price: 20s.

"Child and Adolescent Life in Health and Disease: A Study in Social Pædiatrics", by W. S. Craig, B.Sc. (Glasgow), M.D. (Edinburgh), F.R.C.P.E., F.R.S.E., with a foreword by Professor Charles McNeil, M.A., M.D., F.R.C.P., F.R.C.P.E., F.R.S.E.; 1946. Edinburgh: E. and S. Livingstone Limited. 8½" × 5½", pp. 683, with many illustrations. Price: 25s.

"Bulletin of the Health Organisation", League of Nations, Volume XII, No. 1: Biological Standardisation, Unification of Pharmacopœias; 1945/46. Geneva: League of Nations. Sydney: H. A. Goddard Limited. 9½" × 6½", pp. 179. Price: 6s. 3d.

Diary for the Month.

OCT. 22.—New South Wales Branch, B.M.A.: Ethics Committee.
OCT. 23.—Victorian Branch, B.M.A. Council Meeting.
OCT. 24.—New South Wales Branch, B.M.A.: Clinical Meeting.
OCT. 25.—Queensland Branch, B.M.A.: Council Meeting.
OCT. 31.—South Australian Branch, B.M.A.: Scientific Meeting.
OCT. 31.—South Australian Branch, B.M.A.: Council Meeting.
OCT. 31.—New South Wales Branch, B.M.A.: Branch Meeting.
NOV. 1.—Queensland Branch, B.M.A.: Branch Meeting.
NOV. 5.—New South Wales Branch, B.M.A.: Organization and Science Committee.
NOV. 6.—Western Australian Branch, B.M.A.: Council Meeting.
NOV. 8.—Queensland Branch, B.M.A.: Council Meeting.
NOV. 12.—Meeting of Federal Council, British Medical Association in Australia, Adelaide.
NOV. 12.—Tasmanian Branch, B.M.A.: Ordinary Meeting.
NOV. 13.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
NOV. 13.—Victorian Branch, B.M.A.: Branch Meeting.
NOV. 14.—South Australian Branch, B.M.A.: Council Meeting.
NOV. 19.—New South Wales Branch, B.M.A.: Medical Politics Committee.
NOV. 20.—Western Australian Branch, B.M.A.: General Meeting.
NOV. 21.—Victorian Branch, B.M.A.: Executive Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmain United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phœnix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federated Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178, North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract Practice appointments in Western Australia. All government appointments with the exception of those of the Department of Public Health.

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